



05-GF-113
(3270)
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your community energy company

April 30, 2003

Ms. Lynda L. Dorr
Secretary to the Commission
610 North Whitney Way
Post Office Box 7854
Madison, Wisconsin 53707-7854

Subject: PSC 113.0607 - Maintenance Performance Report and
Updated Preventative Maintenance Plan

Dear Ms. Dorr:

Enclosed find one hard copy and one PDF copy of the Maintenance Performance Report showing compliance with our Preventative Maintenance Plan required every two years under PSC Chapter 113, Section 0607.

In addition, MGE is filing an updated version of its Preventative Maintenance Plan. The plan is being updated to reflect the sale of transmission assets to the American Transmission Company and to clarify language relating to the condition ratings MGE uses.

Sincerely,

David B. Blankenheim
Director - Operations Support

ms

Enclosures

RECEIVED

APR 30 2003

Electric Division

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

I REPORTING REQUIREMENTS

PSC 113.0607(6) Each utility shall provide a periodic report to the commission showing compliance with its Preventative Maintenance Plan. The report shall include a list of inspected circuits and facilities according to the established rating criteria, schedules established and success at meeting the established schedules.

The following tables summarize the data for these requirements.

- Table 1 summarizes inspection cycles.
- Table 2 summarizes planned repair schedules
- Table 3 summarizes inspections completed and results by condition rating.
- Table 4 summarizes inspections scheduled for 2001 and 2002 and inspections completed during this period.
- Table 5 summarizes issues fixed during 2001 and 2002.

“Inspection” is defined as the following.

- A visit to a location of a site or piece of equipment made to inspect and record the existing condition of the equipment at that location.
- Visits to address an issue for a site or location where an incidental inspection was conducted.

Facilities with multiple inspections during a year will be reported as multiple inspections. Facilities with a multi-year inspection cycle may have no inspection during a report cycle. Many facilities have both short inspection cycles for visual operational inspections and longer inspection cycles for more thorough, reconditioning type maintenance inspections.

“Fixed” is defined as the following.

- An issue found during inspection that is directly corrected.
- An issue corrected indirectly during the course of unrelated work or by equipment replacement.
- An issue that is addressed during the course of engineering projects.

Areas inspected are shown in maps included at the end of this report for areas determined geographically. Specific locations can be referenced using the map-grid included with the maps.

Inspections that are scheduled more often than once per year are performed system wide, so no location or circuit information is included.

II INSPECTION SCHEDULE AND METHODS

The following inspection cycles were filed in January, 2001 as a part of MGE’s Preventative Maintenance for Electric Facilities.

Table 1 Summary of Inspection Cycles

FACILITY	As Needed	1 Wk.	2 Wk.	6Mo.	1 Yr.	3 Yr.	4 Yr.	5 Yr.	10 Yr.
HV Distribution									
Overhead HV Distribution Line				X					
Wood HV Distribution Poles									X
Underground HV Distribution		X	X	X	X				
UG Distribution									
Switchgear						X			
Padmount Transformers						X			
Elbow Cabinets						X			
Automatic Transfer Switches			X		X				
Network Vaults			X						
Customer Vaults						X			

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

Table 1 (continued)

FACILITY	As Needed	1 Wk.	2 Wk.	6 Mo.	1 Yr.	3 YR	4 Yr.	5 Yr.	10 Yr.
OH Distribution									
Gang-Op Air Break Switches	X								X
Line Reclosers			X		X			X	
Line Voltage Regulators			X					X	
Overhead Capacitor Banks					X				
Distribution Poles									X
Street Lights							X		X
Substation									
Substation Equipment	X		X		X			X	

The primary methods used in inspection of High voltage distribution and distribution facilities are visual, thermal, and infrared inspection. On the URD system a TDR (Time Domain Reflectometer) is used to assess neutral condition as warranted. Inspections of substation facilities are also primarily done using visual, thermal, and infrared methods. Lab testing is done on oil and gas samples as a part of the maintenance routines.

III CONDITION RATING CRITERIA

Criteria used to rate the condition of facilities falls into three categories.

- Category 1: immediate response required.
- Category 2: timely response required.
- Category 3: address during scheduled maintenance.

Repair and replacement policy provides for different levels of response appropriate for different conditions.

Category 1 - Immediate Response

In any case where public safety could be compromised, or that that indicate an imminent failure likely to cause an outage or damage to equipment, MGE responds immediately to correct the problem. In these cases, the inspector is trained to call an Operations Supervisor.

MGE takes its responsibility toward the environment very seriously. Consequently, problems of an environmental nature receive immediate response.

Category 2 - Timely Response

A timely response is considered to be one that occurs any time before the next inspection. This work is normally assigned to the Construction Department for fill-in work. The approach to Category 2 work is somewhat different for underground facilities because of the very short inspection cycle for this type of facility. Category 2 work is also performed as fill-in work but it is not considered essential that all the work be completed prior to the next inspection just two years away.

Category 3 – Monitoring Status

Category 3 items are maintenance items that, while not likely to create problems prior to the next inspection cycle, may be expected to continue to deteriorate with age. Subsequent inspections will be used to determine the appropriate time to correct these problems.

Environmental issues are handled according to the Company environmental program and policies, and in compliance with relevant regulations

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

IV CORRECTIVE ACTION SCHEDULE

Scheduling of corrective action is based on condition rating. Based on condition, corrective action is taken immediately, prior to next inspection as routine maintenance work, or no action is taken and equipment is monitored.

Table 2

EQUIPMENT OR FACILITY	Units Requiring Repairs	Corrective Action Due Date to comply with PMP	Estimated Completion
UG DISTRIBUTION			
Switchgear	8	Dec 2005	Dec 2003
Padmount Transformers	581	Dec 2004/ Dec 2005	Oct 2003
Elbow Cabinets	54	Dec 2004/ Dec 2005	Nov 2003
Network Vaults	11	N/A	Dec 2003
Customer Vaults	11	N/A	Dec 2004
OH DISTRIBUTION			
Gang-Op Air Break Switches	5	Dec 2012	Dec 2003
4 kV Switches	45	Dec 2012	Dec 2004
Line Reclosers	1	Dec 2007	Dec 2003
Line Voltage Regulators	4	Dec 2007	Dec 2003
Distribution Poles/ Replacements	452	Dec 2011	Jun 2005
Distribution Poles Repairs*	2341	Dec 2011	Jun 2005
Distribution Poles/ Recheck*	2341	N/A	Dec 2003
SUBSTATION			
Station Battery and Rack Systems	1	Dec 2007	Dec 2003
Power Transformers	5	Dec 2007	Dec 2004
Power Circuit Breakers	30	Dec 2007	Dec 2004
Switches	8	Dec 2007	Dec 2003
Regulators	2	Dec 2007	Dec 2003

* There is significant overlap between the repair and recheck categories. Some of these poles will not need any repair. Once a recheck determines that a pole does not need repair, it will be removed from both repair and recheck queues.

V RECORD KEEPING

PSC 113.0607 (4) requires inspection and repair records be retained for a minimum of ten years. Records kept shall include inspection dates, condition rating, scheduled repair and date any repairs are completed.

VI REPORTING REQUIREMENTS

PSC 113.0607 (6) states each utility shall periodically file a report with the commission showing compliance with its filed Preventative Maintenance Plan. The commission shall establish a filing schedule to be at least every two years.

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

VII INSPECTED FACILITIES

Table 3 Facilities Inspected and Issues Found by Category

EQUIPMENT OR FACILITY	TOT # INSPECTIONS 2001-2002	Category 1 Issues Reported	Category 2 Issues Reported	Category 3 Issues Reported
HV DISTRIBUTION				
Overhead HV Distribution Lines	12 lines	0	10	0
Wood HV Distribution Poles	0	0	0	0
Underground HV Distribution	NA	NA	NA	NA
UG DISTRIBUTION				
Switchgear	645	5*	3	280
Padmount Transformers	4,865	587*	14	1,262
Elbow Cabinets	804	54*	2	308
Network Vaults	3,386	0	11	44
Pedestals	+	0	0	19
ATS (2wk)	780	0	0	0
ATS (1yr)	12	0	0	0
Pedestals	31			19
Customer Vaults	265	0	11	235
OH DISTRIBUTION				
Gang-Op Air Break Switches	35	8	11	16
4kV Switches	61	0	16	45
Line Reclosers (5yr)	0	0	0	0
Line Reclosers (1yr ME Control)	31	2	0	0
Line Reclosers (2wk)	1404	5	2	0
Line Voltage Regulators (5 yr)	0	0	0	0
Line Voltage Regulators (2wk)	145	0	4	5
Overhead Capacitor Banks	70	0	0	0
Distribution Poles	15,206	185*	2,686	436
Street Lights	6,866	0	2,252	4,614
SUBSTATION (1yr)				
Station Battery and Rack Systems	66	0	2	5
Power Transformers	222	2	31	46
Load Tap Changers	188	3	9	5
Power Circuit Breakers	910	63	85	119
Switches	1,120	2	21	17
Emergency Generators	6	0	0	0
Relays (by sub)(5yr cycle)	100	0	0	0
Regulators (5yr)	66	0	2	11
Capacitors (5yr)	48	1	2	0
Grounding Systems (by sub)	100	0	0	2
SUBSTATION (2wk)				
Station Battery and Rack Systems	1,716	2	6	3
Power Transformers	5,772	1	18	9
Load Tap Changers	4,888	2	7	3
Power Circuit Breakers	23,660	7	19	11
Switches	29,120	0	5	1
Emergency Generators	156	0	1	0
Regulators	1,716	0	0	0
Capacitors	1,248	0	2	1
Buswork (by sub)	2,600	0	2	0

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

EQUIPMENT OR FACILITY	TOT # INSPECTIONS 2001-2002	Category 1 Issues Reported	Category 2 Issues Reported	Category 3 Issues Reported
Cathodic Protection (by sub)	2,600	0	1	0
Grounding Systems (by sub)	2,600	0	0	0

* The numbers of conditions indicating priority one is the result of overly cautious criteria guidelines. MG&E is reviewing and rechecking these facilities to assure that proper action is taken, and proper priority is assigned. In cases where the inspector considered the condition to be a safety issue or one of imminent failure the condition was called in to an Operations Supervisor for immediate attention.

+ Pedestals are given a general visual check during the elbow cabinet and padmount transformer inspection process.

MG&E conducted a large number of the inspections reported here in late 2002. The plan for remediation of the conditions found is included in the schedule included in this report.

The remediation plan incorporated in this document includes rechecking facilities and repair as appropriate.

Areas inspected for distribution poles, padmount transformers and elbow cabinets are shown on the attached maps. One shows pole inspection history by year and area. The second is URD inspection history by year and area.

Streetlights are done according to a quadrant map as attached.

Facility map-grid locations can be identified using the map grid included with the maps.

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

VIII PLANNED GOALS, SUCCESS RATE

Table 4 Inspections Scheduled and Completed

EQUIPMENT OR FACILITY	TOTAL UNITS ON SYSTEM	SCHEDULED # OF INSPECTIONS 2001- 2002	# OF INSPECTIONS COMPLETED 2001-2002	PERCENTAGE OF TARGET MET
HV Distribution				
Overhead HV Distribution Line	12 radial lines (7.75 mi)	24	12	50%
Wood HV Distribution Poles	130	0	0	100%
Underground HV Distribution	NA	NA	NA	NA
UG DISTRIBUTION				
Switchgear	774	515 <i>See Note</i>	645	125%
Padmount Transformers	7,674	5116	4,865	95%
Elbow Cabinets	1,210	806	804	99.7%
Network Vaults	185	4,810	3,386	70%
Auto Transfer Switch (1yr)	15	12	12	100%
Auto Transfer Switch (2wk)	15	780	780*	100%
Customer Vaults	265	176	265	151%
OH DISTRIBUTION				
Gang-Op Air Break Switches	233	50 <i>See Note</i>	35	70%
4kV Switches	498	100 <i>See Note</i>	61	61%
Line Reclosers (5yr)	27	6 <i>See Note</i>	0	0%
Line Reclosers (1yr ME control)	15	30	31	103%
Line Reclosers (2wk)	27	1,404	1,404	100%
Line Voltage Regulators (5yr)	4	3 <i>See Note</i>	0	0%
Line Voltage Regulators (2wk)	4	208	145	70%
Overhead Capacitor Banks	170	170	70	41%
Distribution Poles	46,806	4,680 <i>See Note</i>	15,206	325%
Street Lights	8,845	4,614	6,866	149%
SUBSTATION (1Yr)				
Station Battery and Rack Systems	33	66	66	100%
Power Transformers	111	222	222	100%
Load Tap Changers	94	188	188	100%
Power Circuit Breakers	455	910	910	100%
Switches	560	1,120	1,120	100%
Relays (by sub)(5yr cycle)	50	20 <i>See Note</i>	10	50%
Regulators (5yr)	33	66	66	100%
Capacitors (5yr)	24	48	48	100%
Grounding Systems (by sub)	50	100	100	100%

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

Table 4 (continued)

EQUIPMENT OR FACILITY	TOTAL UNITS ON SYSTEM	SCHEDULED # OF INSPECTIONS 2001- 2002	# OF INSPECTIONS COMPLETED 2001-2002	PERCENTAGE OF TARGET MET
SUBSTATION (2wk)				
Station Battery and Rack Systems	33	1716	1716	100%
Power Transformers	111	5772	5772	100%
Load Tap Changers	94	4888	4888	100%
Power Circuit Breakers	455	23,660	23,660	100%
Switches	560	29,120	29,120	100%
Regulators	33	1,716	1,716	100%
Capacitors	24	1,248	1,248	100%
Buswork (by sub)	50	2,600	2,600	100%
Cathodic Protection (by sub)	50	2,600	2,600	100%
Grounding Systems (by sub)	50	2,600	2,600	100%

Note: These items have multiyear inspection windows. In order to maximize efficiency, these inspections are done in groups. The "SCHEDULED # OF INSPECTIONS 2001- 2002" column represents the number of items to be inspected divided by the number of years in the cycle. Therefore, inspections completion percentages much higher or lower than 100% do not imply a material deviation from the plan, and MG&E will complete all required inspection by the end of the inspection cycle for each piece of equipment.

*The records for bi-weekly inspection of automatic transfer switchgear were not kept. Records for these facilities will be maintained in the future.

MGE was generally successful at meeting established goals in our cycles. In many cases MG&E performs inspections in ways that take advantage of natural cycles in the work load, rather than dividing the facilities to be inspected evenly across the inspection window. As a result, some equipment is will show more than 100% completion and some less. Over the course of the inspection window appropriate to any facility MG&E will complete 100% of scheduled inspections.

Examples include Gang-Operated switches at 70% completion indicating that Padmounted switchgear will be inspected in the later years of the cycle, and poles at 325% completion indicating that poles are being inspected earlier in the cycle than simple division would suggest.

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

VIII PLANNED GOALS, SUCCESS RATE (continued)

Table 5 Issues Fixed

EQUIPMENT OR FACILITY	Category 1 Reported	Category 1 Fixed	Category 2 Reported	Category 2 Fixed	Category 3 Reported	Category 3 Fixed
HV DISTRIBUTION						
Overhead HV Distribution Line	0	0	10	10	0	0
Wood HV Distribution Poles	0	0	0	0	0	0
Underground HV Distribution	NA	NA	NA	NA	NA	NA
UG DISTRIBUTION						
Switchgear	5	0	3	0	164	0
Padmount Transformers	587* (20)	20	14	0	1,262 (23)	23
Elbow Cabinets	54* (2)	2	2	0	308 (6)	6
Network Vaults	0	0	11	0	44	0
ATS (1yr)	0	0	0	0	0	0
ATS (2wk)	0	0	0	0	0	0
Customer Vaults	0	0	11	0	235	0
OH DISTRIBUTION						
Gang-Op Air Break Switches	8	8	11	6	16	0
4kV Switches	0	0	16	3	45	0
Line Reclosers (5yr)	0	0	0	0	0	0
Line Reclosers (1yr)	2	1	0	0	0	0
Line Reclosers (2wk)	3	4	2	1	1	1
Line Voltage Regulators (5yr)	0	0	5	1	4	2
Line Voltage Regulators (2wk)	0	0	5	1	4	2
Overhead Capacitor Banks	0	0	0	0	0	0
Distribution Poles	185* (40)	40	2,686 (38)	38	436 (8)	8
Street Lights	0	0	2,252	2,252	4,614	4,614
SUBSTATION (1yr) #						
Station Battery and Rack Systems	0	0	2	1	5	0
Power Transformers	2	2	31	26	46	20
Load Tap Changers	3	3	9	9	5	3
Power Circuit Breakers	63	63	85	56	119	52
Switches	2	2	21	13	17	6
Emergency Generators	0	0	0	0	0	0
Relays (by sub)(5yr cycle)	0	0	0	0	0	0
Regulators (5yr)	0	0	2	0	11	3
Capacitors (5yr)	1	1	2	2	0	0
Grounding Systems (by sub)	0	0	0	0	2	1
Communication Systems (by sub)	0	0	0	0	0	0

Table 5 (continued)

EQUIPMENT OR FACILITY	Category 1 Reported	Category 1 Fixed	Category 2 Reported	Category 2 Fixed	Category 3 Reported	Category 3 Fixed
SUBSTATION (2wk) #						
Station Battery and Rack Systems	2	2	6	6	3	2
Power Transformers	1	1	18	18	9	8
Load Tap Changers	2	2	7	7	3	3
Power Circuit Breakers	7	7	19	19	11	7
Switches	0	0	5	5	1	1
Emergency Generators	0	0	1	1	0	0
Regulators	0	0	0	0	0	0
Capacitors	0	0	2	2	1	1

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

EQUIPMENT OR FACILITY	Category 1 Reported	Category 1 Fixed	Category 2 Reported	Category 2 Fixed	Category 3 Reported	Category 3 Fixed
Buswork (by sub)	0	0	2	2	0	0
Cathodic Protection (by sub)	0	0	1	1	0	0
Grounding Systems (by sub)	0	0	0	0	0	0

* The numbers appearing in parentheses indicate that the inspectors phoned a report to an Operations Supervisor, indicating a priority one response was needed, the remainder of the items reported were submitted for additional review.

MG&E did not attempt to separate ATC equipment for purposes of this report. The process of separating ATC records from MG&E's during normal maintenance is underway.

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

Using the line crew personnel to detect and correct damaged or failing facilities has long been an integral part of MG&E's maintenance strategy. In addition to the items listed above, MG&E line crew personnel identified and repaired 531 items of varying degrees of severity.

Padmount transformers, elbow cabinets, and poles all had large inspection areas completed in late 2002 and this is reflected in the number of items remaining to be repaired. The schedule included shows the planned timing for correction of these conditions.

Schedule of repairs for work identified during routine inspections

IX FACILITY CONDITION – RATING

For a number of facilities, inspections were completed ahead of time for the current cycle by inspecting much or all of the facilities together. Issues found during these inspections will be remedied as required by their condition in the remaining duration of the cycle.

HIGH VOLTAGE DISTRIBUTION FACILITIES

MGE has turned over transmission facilities to the American Transmission Company (ATC) as of January 1, 2001. MGE retains some high voltage distribution that interconnects ATC facilities and MGE distribution facilities. The remaining high voltage distribution totals 7.75 miles. Foot patrol inspections of these remaining radials continue. Category 2 issues found were all addressed. Wood high voltage distribution poles were inspected in 2000 and are due in again 2010.

OVERHEAD DISTRIBUTION FACILITIES

The majority of switches, Gang-Operated Air Break (GOAB) and 4 kV switches, scheduled for inspection for 2001 and 2002 were inspected. All Category 1 issues were addressed, affecting just over 1% of all switches.

Bi-weekly and annual control inspections of reclosers were completed as scheduled. Five reclosers had category 1 issues. No five-year inspections were scheduled in 2001 or 2002.

70% of the planned bi-weekly inspections of voltage regulators were completed as scheduled. No major issues were found. No five-year inspections were planned in 2001 or 2002.

Overhead capacitor banks have been inspected meeting 40% of scheduled target. Capacitor inspections are being performed in 2003. Capacitor banks on the system historically have been very reliable. Completing fewer inspections than scheduled has not proven to compromise customer reliability.

Scheduled inspections for overhead distribution poles exceeded 100% of the planned target, working ahead in the cycle. MG&E performed a large number of inspections in late 2002 and the results are reflected in the planned repair schedule, which appears in this document.

Street light inspections completed met 100% of the scheduled target, and additional units were addressed through unscheduled maintenance.

MG&E continues to complete voltage conversion projects upgrading aging 4 kV facilities to 14 kV in our service territory. These projects will address issues found during inspections within respective project areas at the time construction. This work will be instrumental in keeping our system in good operating condition.

UNDERGROUND DISTRIBUTION FACILITIES

TWO YEAR REPORT DOCUMENTING COMPLIANCE WITH PREVENTATIVE MAINTENANCE PLAN

Underground distribution facility inspections were completed in 2001 and 2002 that are consistent with the design of the maintenance plan.

All padmount transformer inspections and elbow cabinet inspections scheduled for 2001 and 2002 were completed. 2002 inspections were completed in the fall.

MGE continues to address aging underground cable through an aggressive underground cable replacement program. This work will be instrumental in keeping our system in good operating condition.

SUBSTATION FACILITIES

Substation facility inspections were completed 100% as scheduled. All category 1 issues found have been addressed and the majority of category 2 issues have been addressed, and the remainder will be completed in accordance with the plan. For practical reasons, MG&E did not exclude inspections, and work performed or scheduled for ATC equipment in the substations. Separation of ATC from MG&E equipment in normal maintenance and record keeping activity is in progress at this time.

MGE is implementing a computerized maintenance management system in the first half of 2003 that will improve data acquisition and accuracy for the company's substation inspection and maintenance program. The benefit of the new system will be improved data acquisition and accuracy of inspection and maintenance information, and the management of the resulting work.

Overall Condition

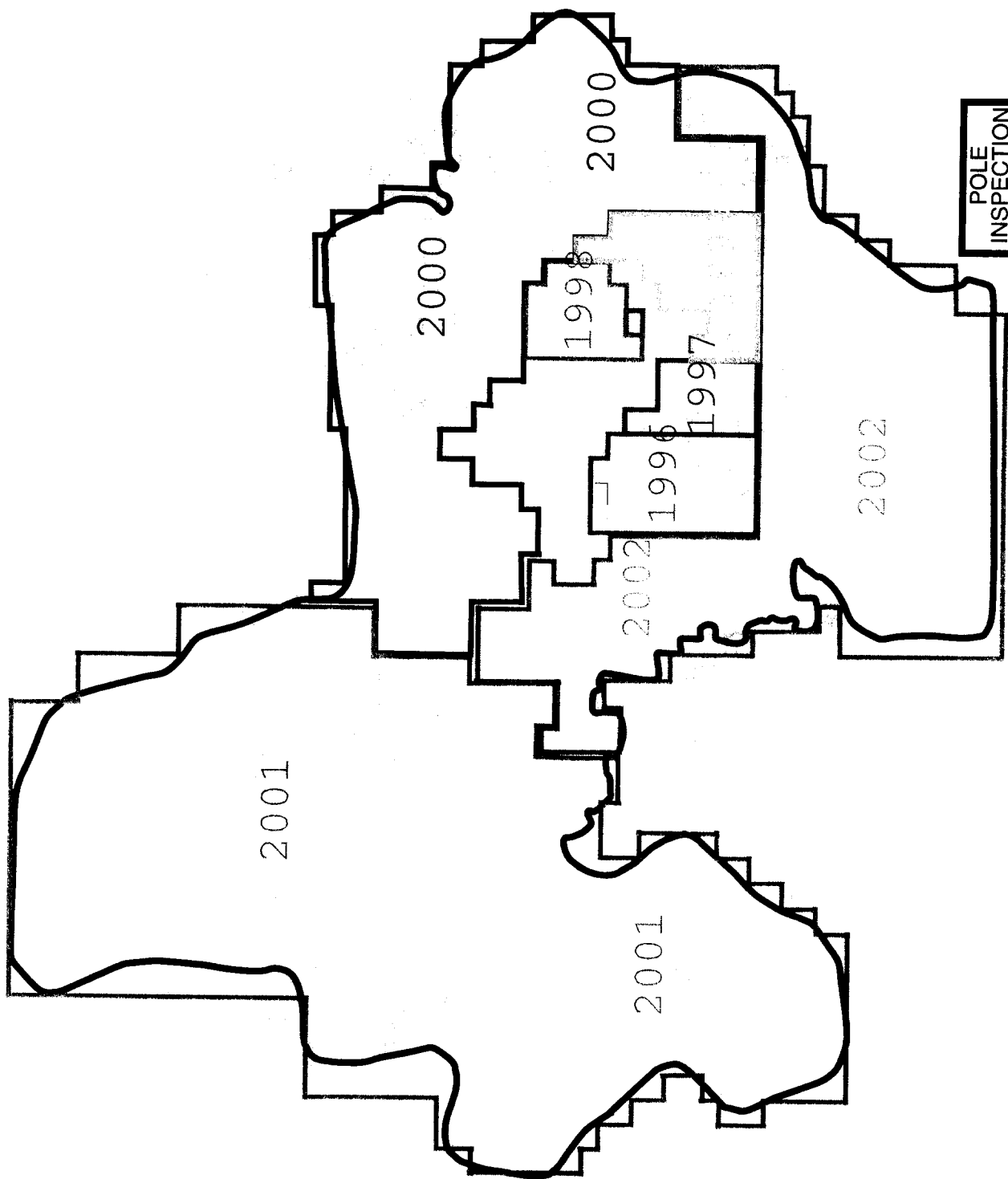
The overall condition of MG&E's system is excellent. The relatively few serious problems identified during the inspection process, and MG&E's system reliability demonstrate a sound overall distribution system. MG&E is continuing aggressive replacement of underground cables as they reach an age of 30 years. Additionally, MG&E is converting portions of the 4 KV distribution system to 14 KV. During this process, significant areas are rebuilt to a "like-new" condition.

Using the line crew personnel to detect and correct damaged or failing facilities has long been an integral part of MG&E's maintenance strategy. In addition to the items listed above, MG&E line crew personnel identified and repaired 531 items of varying degrees of severity.

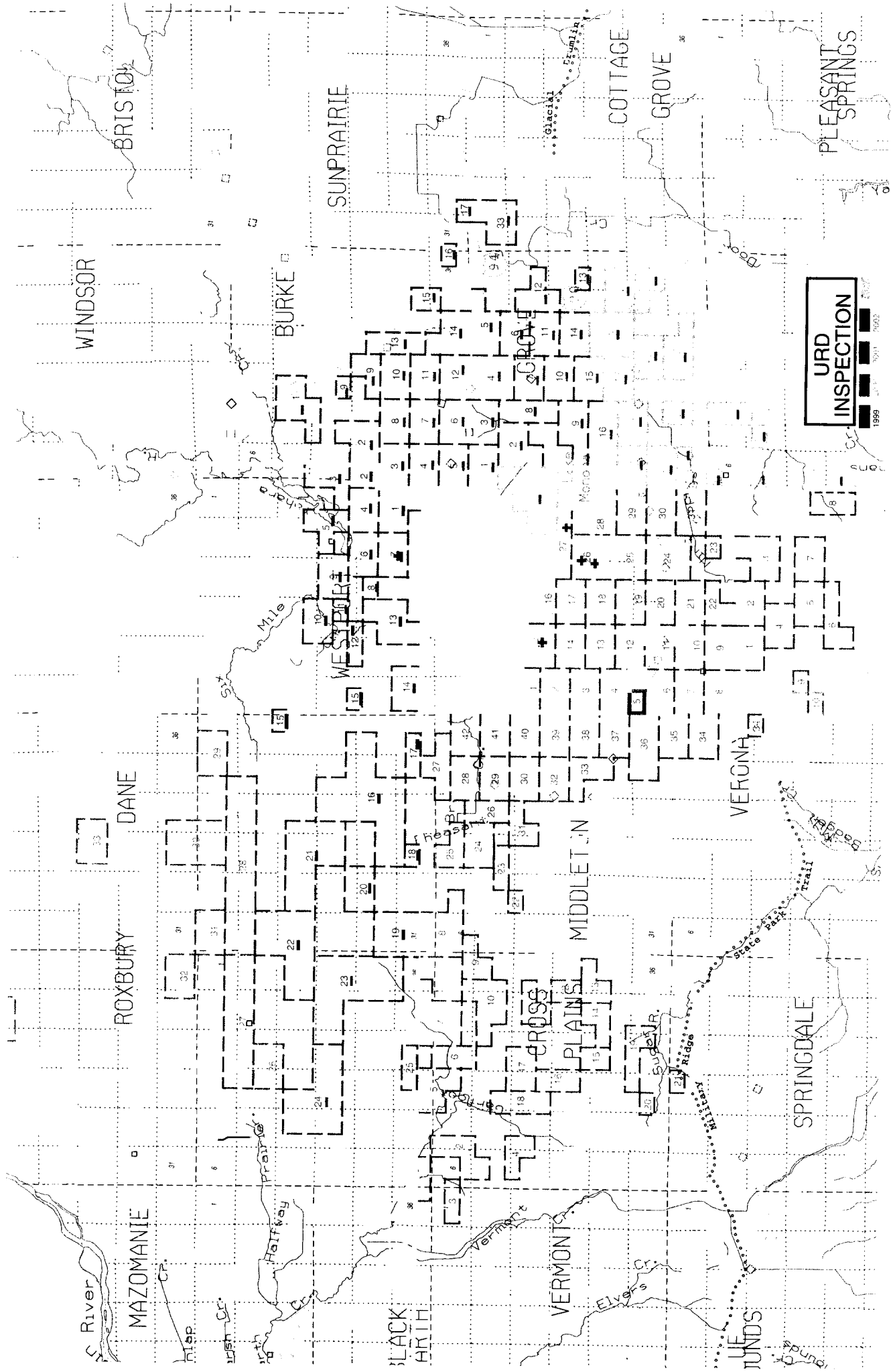
X MAPS AND REFERENCE DOCUMENTS

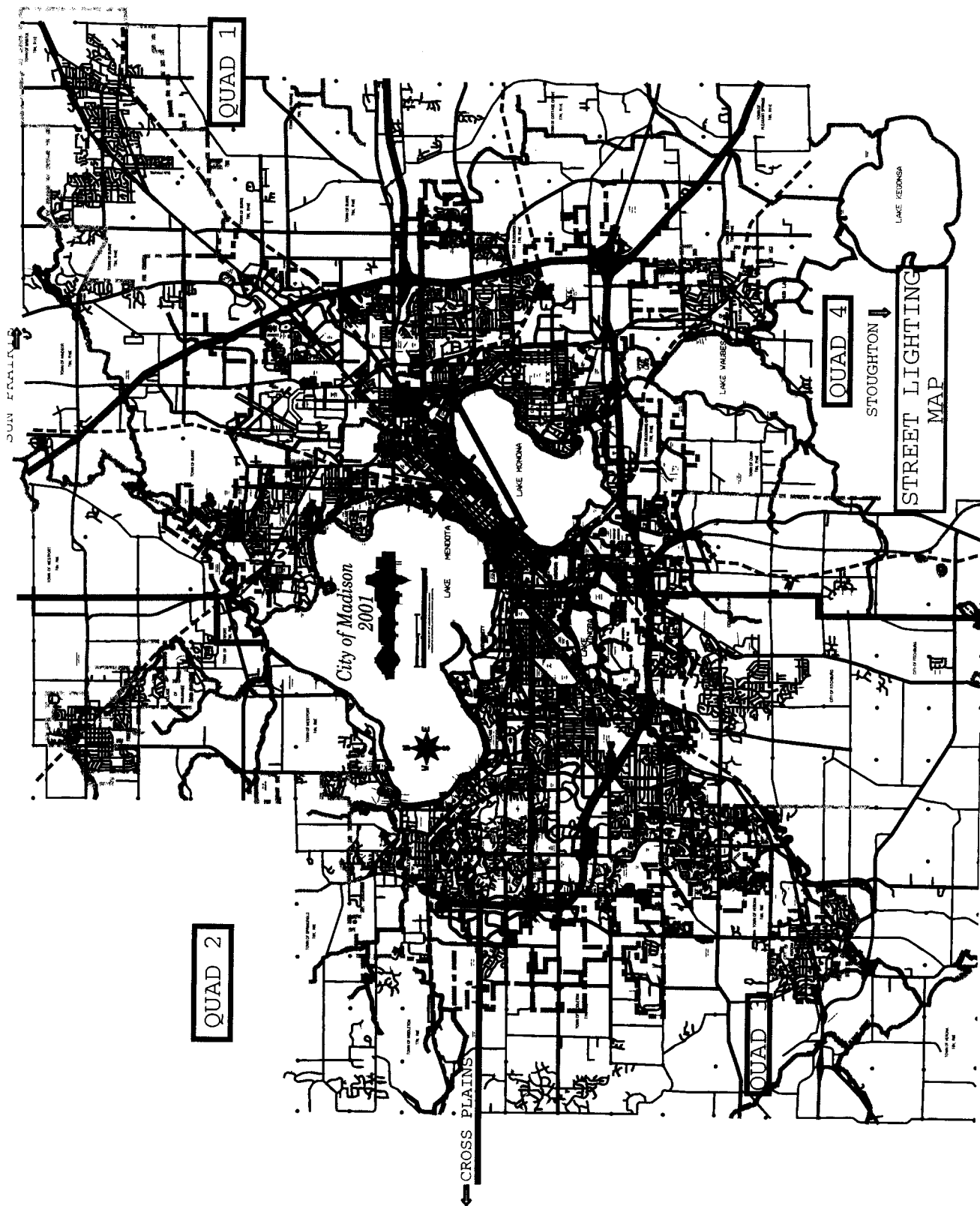
The following reference maps and documents are included to summarize facilities inspected.

- Pole Inspection Segments and History.
- URD Inspection Segments and History.
- Street light inspection quadrants.
- Map-grid providing reference within the MGE electric system by map-grid number.



POLE
INSPECTION
MADE ELECTRIC SERVICE AREA





**Submitted by
Madison Gas and Electric Company
to the
Public Service Commission of Wisconsin
PSC 113.0607**



**Preventative Maintenance Plan
for Electric Facilities**

April 30, 2003

MGE - Preventative Maintenance Plan for Electric Facilities

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MGE - Preventative Maintenance Plan for Electric Facilities

Overview

Madison Gas and Electric Company (MGE) has compiled a comprehensive maintenance plan that articulates the Company's practices for inspecting and maintaining electric operating facilities.

Preventative maintenance for distribution equipment, outside of substation facilities, is based on results of regularly scheduled inspections.

Much of this equipment is static, performing its function just by existing where it does on the system, like a pole or guy wire. For many of these facilities, remediation or replacement is prudent upon imminent or actual failure. Action taken as a result of inspections is sufficient to maintain reliability in these cases.

For active equipment on the system, it is important for the more complex and critical parts of the system to be operational when needed. Active equipment is inspected and maintained to ensure this equipment can carry out the needed function on the system, thus ensuring system reliability.

Inspections and preventative maintenance for substation facilities are completed according to the schedules and guidelines specified in the Substation Maintenance Standards. Substation facilities are generally considered to be active and require significant inspection and maintenance.

MGE's inspection and maintenance meet inspection standards included in the *National Electrical Safety Code*.

Report forms, checklists, and guidelines for electric facility inspections are included as appendices for reference.

MGE - Preventative Maintenance Plan for Electric Facilities

Distribution and Substation Facilities

Introduction

Distribution and substation facilities can be viewed as static or active.

Static equipment includes items like supporting structures, cabinets, and many interconnecting parts that bring the system together. These items are generally designed to operate 20 years or more without any planned maintenance and have few, if any, moving parts. MGE's approach to maintaining static equipment consists of regular inspections to detect imminent or actual failures and repairing or replacing the components as necessary. The inspection cycle is chosen to eliminate the need to track equipment that might be deteriorating. If a piece of equipment cannot be counted on to safely reach the next inspection, it is replaced.

Active equipment is likely to have moving parts, sensors, oil, load break contacts, or other parts that could fail, possibly without immediate indication. MGE's approach to these items is frequent and routine inspections, along with scheduled testing and maintenance appropriate for the piece of equipment consistent with manufacturer's recommendations and industry practice.

Active equipment in this category may have a progressive maintenance condition that will deteriorate in a predictable way. An example of this is elevated levels of certain gases in oil-filled equipment. Such an elevated level may indicate a developing problem, but the situation may not require immediate action.

The Company will also perform regular maintenance on this equipment. This would include actions such as changing the contact, performing timing or other tests, filtering oil, etc.

In the event that a large or expensive piece of equipment is found to be in a state where major repair or replacement is immediately necessary, the Company will replace it with available equipment. After prompt removal of the affected equipment, a repair or replacement budget is prepared for the next budget year or existing budgets are adjusted. Smaller repairs are budgeted based on historical experience of maintenance requirements for this type of equipment.

Methods and Tools

The primary methods used in inspection of transmission and distribution facilities are visual, thermal, and infrared inspection. On the underground distribution system, a TDR (Time Domain Reflectometer) is used to assess neutral condition. Inspections of substation facilities are also primarily done using visual, thermal, and infrared methods. Lab testing is done on oil and gas samples as a part of the maintenance routines.

Relays and other sensing equipment undergo a variety of tests according to manufacturers' recommendations. This testing requires relay test equipment and computer software. Increasingly, these tests are incorporated into the equipment itself and the monitoring is automated.

Condition Criteria

Criteria used to rate the condition of facilities falls into four categories. The categories prioritize issues by immediate response required (Category 1), timely response required (Category 2), address during scheduled maintenance (Category 3), and acceptable operating condition (Category 4).

Repair and replacement policy provides for different levels of response appropriate for different conditions.

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Category 1 - Immediate Response

In any case where public safety may be compromised or where conditions indicate that an immediate failure is likely to cause an outage or damage to equipment, MGE will respond immediately to make the situation safe. The inspector will notify an operations supervisor by telephone in these cases or, if the inspector is an MGE crew capable of correcting the problem, a system maintenance report will be made out.

MGE takes its responsibility toward the environment very seriously. Consequently, problems of an environmental nature receive immediate response.

Category 2 - Timely Response

A timely response is generally considered to be one that occurs any time before the next inspection. This work is normally assigned to the Construction Department for fill-in work. For underground distribution equipment, a timely response may occur after the next inspection due to the very short inspection cycle used.

Category 3 – Monitoring Status

Category 3 items are maintenance items that, while not likely to create problems prior to the next inspection cycle, may be expected to continue to deteriorate with age. Subsequent inspections will be used to determine the appropriate time to correct these problems.

Substation and transmission facilities typically include more active equipment. As a result, minor issues will be corrected during the next scheduled maintenance. Issues involving larger and more complex equipment will be monitored, and an appropriate and economic solution will be planned.

Category 4 – Acceptable Operating Condition

Category 4 items are in acceptable operating condition at the time of inspection. No action is required until the next scheduled inspection.

Budgeting

Budgeting for routine repairs and maintenance items throughout MGE's system is based on historical experience. Each year the operating departments review the past year's experience with respect to maintenance and repair activity. The next year's budget is adjusted to reflect historical trends and anticipate future needs.

In the event that a large or expensive piece of equipment is found to be in a state where major repair or replacement is necessary, the Company will replace it with available equipment. After prompt removal of the affected equipment, a repair or replacement budget is then prepared for the next budget year or budgets are adjusted accordingly.

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High-Voltage Distribution Inspection Summaries

Overhead Lines

Item	Interval	Description	Inspection	Correction
Walking	Annual	<ul style="list-style-type: none">• Pole condition and guys• Attached hardware• Conductor condition• Signage• Right-of-way condition• Foundation condition	<ul style="list-style-type: none">• Spreadsheet in Electric Operations	<ul style="list-style-type: none">• Maintenance reports/SRO

High-voltage distribution lines are visually inspected twice a year. Inspected items include:

- Insulators
- Ground wire and ground wire moldings
- Guy shields
- Signage
- Tree growth
- Paint condition
- Supporting structures

Each structure is inspected according to the patrol checklist for each specific line. Issues are noted and transcribed into an electronic spreadsheet maintained by Electric Operations.

Issues found requiring immediate attention are resolved as soon as feasible. Issues not requiring immediate attention are handled as time permits according to their priority. Work done to resolve issues can be traced through the job order system and field crew time sheets.

Condition criteria

Category 1

- Unauthorized persons working on easement
- Floating (unattached) static wire
- Multiple broken insulators compromising safety
- Leaning or damaged structures

Category 2

- Multiple broken insulators compromising reliability
- Damaged conductors
- Trees requiring nonroutine trimming to prevent imminent outages

Category 3

- Single broken insulators
- Right-of-way maintenance, changed conditions, and possible encroachment
- Trees requiring routine trimming

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Wood High-Voltage Distribution Poles

Item	Interval	Description	Inspection	Correction
Pole	10 years	<ul style="list-style-type: none">• Pole type and age• Deterioration and insect infestation• Decision to repair/replace, treat pole butt• All items identified by walking inspection	<ul style="list-style-type: none">• Hard copy report• Kept in Electric Operations	<ul style="list-style-type: none">• Maintenance reports/SRO

Wood poles undergo additional ground line inspection and treatment on a ten-year cycle. Inspections determine which poles are treated or replaced. While performing ground-line inspections, pole hardware and attachments are visually inspected. Inspection reports are provided by the contractor after performing the work and are filed in Electric Operations. The follow-up work can be found in job order documentation and crew time sheets.

Condition criteria

Category 1

- Loose hardware on poles
- Poles with dangerous amounts of pole rot or other structural damage
- Missing ground moldings or guy shields
- Missing or damaged warning signs

Category 2

- Poles that no longer meet codes for structural strength
- Damaged poles
- Ground wire molding or guy shields
- Missing or damaged warning signs

Category 3

- Routine replacement or reinforcement of damaged or aged poles
- Repairing grounds and static connections

Underground High-Voltage Distribution

Item	Interval	Description	Inspection	Correction
Facility Patrol	Weekly	<ul style="list-style-type: none">• Right-of-way condition and activity• Ground and site condition• Structures and related hardware	<ul style="list-style-type: none">• Kept in Corp. Records	<ul style="list-style-type: none">• Maintenance reports/SRO

The underground high-voltage system is patrolled weekly. Items inspected include:

- Any construction or renovation
- Tree growth
- Ground condition
- Manhole covers
- Signage
- Riser structures
- Substation fence and appearance

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Anodes are inspected twice each year and adjustments and repairs are made as needed. Line patrol reports are completed, routed internally, and stored in Corporate Records.

Condition criteria

Category 1

- Unauthorized digging on the right-of-way
- Active oil leaks
- Fencing missing or damaged

Category 2

- Located routes indicated near trench routes for excavation
- Vandalism
- Damaged or missing signage

Category 3

- Deteriorated manholes
- Rusted manway or manhole covers

Special High-Voltage Distribution Issues

Item	Interval	Description	Inspection	Correction
Thermal Imaging (tester and camera)	As needed	• Check for hot spots on equipment	• Test results noted • Kept in Operations Support	• Maintenance reports/SRO

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Distribution Inspection Summaries

Distribution facility inspections include:

- Underground distribution equipment
- Overhead distribution equipment
- Wood poles including signage and hardware
- Distribution network vault system including spot and grid facilities
- Company-owned equipment in customer-owned vaults

Underground Distribution

Item	Interval	Description	Inspection	Correction
Switchgear	3 years	<ul style="list-style-type: none">• Equip. configuration• Protection information• As-built details	<ul style="list-style-type: none">• Electronic transfer and storage by Operations Support	<ul style="list-style-type: none">• SRO
Transformers	3 years	<ul style="list-style-type: none">• Equip. configuration• Protection information• As-built details	<ul style="list-style-type: none">• Electronic transfer and storage by Operations Support	<ul style="list-style-type: none">• SRO
Elbow cabinets	3 years	<ul style="list-style-type: none">• Equip. configuration• As-built details	<ul style="list-style-type: none">• Electronic transfer and storage by Operations Support	<ul style="list-style-type: none">• SRO
Pedestals	With transformers and cabinets	<ul style="list-style-type: none">• General condition	<ul style="list-style-type: none">• By exception only	<ul style="list-style-type: none">• SRO

Underground distribution facilities are inspected every three years. Equipment inspected includes:

- Switchgear
- Transformers
- Elbow cabinets
- Pedestals

Equipment configuration, including switch and fuse information, is verified using hard copies of switch diagrams. Notes and as-built details are recorded and relayed to Drafting Services for correction.

Issues addressed during inspection include:

- Installation condition
- Signage
- Hardware condition

Follow-up work is tracked using hard copy reports, job orders, and crew time sheets. These records are kept in Electric Operations.

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Condition criteria guidelines

Category 1 (Safety or imminent failure)

- Open cabinets, missing locks
- Cabinets with rust holes
- Damaged cabinets where live equipment is accessible to the public
- Swollen and leaking elbows
- Active oil leaks

Category 2

- Overheated connections
- Animal damage
- Damaged protective posts
- Swollen elbows
- Displaced on pad
- Missing pentahead bolts

Category 3

- Cabinets requiring painting
- Pads requiring straightening
- Signs, (replaced at inspection)

Underground Distribution Network Vaults

Item	Interval	Description	Inspection	Correction
Network vaults	Biweekly*	<ul style="list-style-type: none">• Number of operations• Position of protective devices• Transformer information	<ul style="list-style-type: none">• Hard copy records• Electronic pilot program under way• Corp. Records	<ul style="list-style-type: none">• Maintenance reports/SRO
*1 year for correction purposes				

Underground distribution network vaults are inspected every two weeks. Items inspected include:

- Number of operations
- Position of protective devices
- Transformer disconnect position
- Transformer oil level
- Transformer temperature
- General conditions

Condition criteria

Category 1

- Damaged network equipment
- Malfunctioning protectors
- Dangerous vault covers and equipment
- Excessive water

Category 2 (Repair schedule for one year)

- Cable damage including abrasion and leaks

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Category 3

- Equipment requiring cleaning
- Equipment requiring painting
- Rust on vault covers
- Minor damage to vault covers
- Minor water
- Missing lights

Customer-Owned Vaults

Item	Interval	Description	Inspection	Correction
Customer-owned vaults	3 years	<ul style="list-style-type: none">• Transformer condition• Cable/wire condition• Vault security	<ul style="list-style-type: none">• Inspection report files• Stored in Electric Operations• Electronic summary	<ul style="list-style-type: none">• Maintenance reports/SRO

Company-owned equipment in customer-owned vaults is inspected about every three years. In addition to inspection, cleaning is also done. Inspection items include:

- Transformer condition
- Primary and secondary service wire condition
- Vault security including locks
- Lighting and signage

Issues found are recorded on the Customer-Owned Transformer/Enclosure Inspection form (see Appendix E). Follow-up work can be tracked in the job order system and the field crew time sheets.

Condition criteria

Category 1

- Unsecured facilities
- Active oil leaks

Category 2

- Malfunctioning protectors
- Cable damage
- Signage

Category 3

- Equipment requiring cleaning
- Painting of equipment
- Enclosures requiring weed control

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Overhead Gang-Operated Air Break (GOAB) Switches

Item	Interval	Description	Inspection	Correction
Switches	10 years	• Equipment condition	• Hard copy in Electric Operations	• Maintenance reports/SRO
	As needed	• Operating condition	• Time sheets	• Maintenance reports/SRO

Switch inspection items include insulators, contacts, jumpers, and operating condition. Overhead switches are inspected every ten years or as needed. Follow-up work can be tracked in the job order system and field crew time sheets.

Condition criteria

Category 1

- Broken insulators/supports
- Missing locks
- Unsafe mounting

Category 2

- Inoperable
- Damaged control handles
- Bad connections
- Minor lightning damage
- Overheated switchblades

Category 3

- Switches that require lubrication

Overhead Capacitor Banks

Item	Interval	Description	Inspection	Correction
Capacitor banks	Biannual	• Switch condition • Capacitor condition • Switch and control operation • Arrester/cutout condition	• Operations Support	• Maintenance reports/SRO

Capacitor banks are inspected every second year and maintenance items that need to be addressed are recorded. work.

Condition criteria

Category 1

- Swollen units
- Leaks
- Excessive operations

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Category 2

- Blown fuses
- Maintenance on controls
- Hot connections

Category 3

- Damaged animal guards
- Bird nests

Overhead Distribution Poles

Item	Interval	Description	Inspection	Correction
Poles	10 years	<ul style="list-style-type: none">• Pole condition near the ground line• Visual inspection of attached hardware	<ul style="list-style-type: none">• Hard copy in Electric Operations	<ul style="list-style-type: none">• SRO

Distribution poles undergo rigorous ground line inspection every 10 years. The primary goal of this inspection concerns pole condition near the ground line. A visual inspection is done concerning the attached hardware. Issues are noted in the inspection records and handled accordingly.

Follow-up notes are kept in Electric Operations. Follow-up work concerning rejected poles can be traced to job orders in the job order system and on field crew time sheets.

Condition criteria

Category 1

- Poles that are broken or unsupported
- Leaning poles that create a hazardous situation
- Broken insulators

Category 2

- Cracked insulators
- Broken crossarms
- Leaning poles
- Poles with ground rot or charring
- Poles with ground-line damage
- Damaged down guys
- Trees requiring nonroutine trimming

Category 3

- Routine maintenance required on aged equipment
- Trees requiring routine trimming
- Secondary and services requiring work or replacement

Substation Inspection Summaries

Overview

Substations are inspected according to guidelines defined in the Substation Maintenance Standards. Inspections are done biweekly, and more comprehensive inspections are done once every five years or more and include preventative maintenance activities. The exact schedule varies with each piece of equipment.

Results of routine inspections are captured in an exception report kept as an electronic spreadsheet. A hard copy logbook is kept at each substation where readings, comments, and inspectors' initials are recorded.

Results of comprehensive inspections are stored electronically by field personnel on a portable computer and backed up on the computer network.

Follow-up work is assigned based on criticality of the issue, resulting in less critical work done as time permits. Some notes are kept on paper copies as needed.

Guidelines and schedules for routine and comprehensive inspections are included in MGE's Substation Maintenance Standards (see Appendix C for table of contents).

Included in Appendix I are reporting forms that Electric Meter Shop generally use as guidelines for completed inspections. These forms are for line reclosers, automatic transfer switchgear, voltage regulators, nitrogen at substations and presently, backup generators.

Condition criteria for substation facilities:

Category 1

- Any oil leaks where oil is actively leaking to the ground
- Power outages
- Equipment leaks
- Compressor problems
- Improper voltage regulation

Category 2

- Oil weeping on equipment (not on ground)
- Oil filtering due to low dielectric found on annual inspections
- Grounds in DC system

Category 3

- Annual oil samples
- Annual battery maintenance
- Oil leaks internal to equipment

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Substation Maintenance Standards

The Substation Maintenance Standards (SMS) are the protocol for inspection and maintenance work. This includes what is done during inspections conducted on cycles of weeks, maintenance and testing done on cycles of years, and any additional tests or procedures that may be needed.

The maintenance standards include sections on the following equipment:

- Station batteries, racks, and chargers
- Power transformers
- Load tap changers
- Power circuit breakers
- Switches
- Bus work
- Emergency generators
- Relays
- Reclosers
- Regulators
- Capacitors
- Grounding systems
- Communications systems

Other information in the standards includes hard copy forms used for inspection, testing and maintenance, and information on test equipment. Sections addressing environmental concerns and general safety are also included.

Station Batteries, Racks, and Chargers

Interval	Description	Inspection	Correction
Biweekly	<ul style="list-style-type: none">• Visual• Battery check	<ul style="list-style-type: none">• Exception report	<ul style="list-style-type: none">• Exception report• Cascade
Annual	<ul style="list-style-type: none">• Visual• Battery measurements	<ul style="list-style-type: none">• Electronic documents	<ul style="list-style-type: none">• Job orders• Cascade

Biweekly inspections include:

- Overall visual inspection of batteries and associated equipment to check for deterioration
- Electrolyte fluid level and leaks
- Battery charger voltage, currents, and grounds

Annual inspections include:

- Cell impedance checks
- Cell voltage checks
- Specific gravity checks
- Strap resistance between cells
- Clean up connection points (clean, grease, and torque)

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Power Transformers

Interval	Description	Inspection	Correction
Biweekly	<ul style="list-style-type: none">• Visual• Transformer systems check	<ul style="list-style-type: none">• Exception report	<ul style="list-style-type: none">• Exception report• Cascade
Annual	<ul style="list-style-type: none">• Visual• Thermal imaging• Oil sample• Gas analysis and sample	<ul style="list-style-type: none">• Electronic documents• Lab reports	<ul style="list-style-type: none">• Job orders• Cascade
As needed	<ul style="list-style-type: none">• Visual• Transformer tests• Process oil	<ul style="list-style-type: none">• Electronic documents	<ul style="list-style-type: none">• Job orders• Cascade

Biweekly inspections include:

- Nitrogen gas pressure checks
- Gas and oil leaks
- Oil level and temperature check
- Winding temperature
- Cooling fan status
- Oil circulating pump status
- Porcelain condition
- Desiccant filter condition
- Compartment heaters

Annual inspections and maintenance include:

- Transformer oil levels (including bushings and conservator)
- Bushing condition
- Cooling system including fan and oil circulating pump, controls, lubing as necessary, and debris removal
- Perform infrared scan on radiators
- Check control wiring and junction boxes
- Check grounding including pad and surrounding grid
- Perform oil tests for dielectric, color, and acidity
- Combustible gas analysis using a portable unit, purging or pressurizing nitrogen gas as necessary
- Dissolved gas sample from transformer for outside lab analysis

Additional tests done as needed include:

- Transformer tests
- Internal visual inspection of transformer condition
- Impedance tests of coil and core
- Filter oil and heat process oil, new or existing
- Power factor test when transformer is new or tap position is changed
- Turns ratio test when transformer new or tap position is changed
- Dielectric absorption test to check insulation

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Load Tap Changers

Interval	Description	Inspection	Correction
Biweekly	<ul style="list-style-type: none">• Visual	<ul style="list-style-type: none">• Exception report	<ul style="list-style-type: none">• Exception report• Cascade
Annual	<ul style="list-style-type: none">• Visual• Exercise equipment• Oil sample for test	<ul style="list-style-type: none">• Electronic documents• Lab reports	<ul style="list-style-type: none">• Job orders• Cascade
As needed	<ul style="list-style-type: none">• Visual• Check contact• Filter oil• Turns ratio test	<ul style="list-style-type: none">• Electronic documents	<ul style="list-style-type: none">• Job orders• Cascade

Biweekly inspections include:

- Check for oil level, oil and gas leaks
- Veeder count (number of operations)
- Tap position and range, resetting drag hands as applicable
- Control setting and mode
- Compartment heaters

Annual inspections include:

- Oil sample for dielectric, color, and acidity
- Operate tap changer control and verify control sequence and alarms
- Operate load tap changer over a range of positions and the off positions
- Compartment heaters

Additional tests done as needed include:

- Internal visual inspection of connections and parts
- Check condition of contacts and drag fingers, and replace as needed
- Filter oil
- Perform a turns ratio test when commissioning a transformer or as needed, operating through all the tap positions

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Power Circuit Breakers

Interval	Description	Inspection	Correction
Biweekly	• Visual	• Expectation report	• Expectation report • Cascade
Annual	• Pneumatic equipment check • Oil sample	• Electronic documents • Lab reports	• Job orders • Cascade
5 Years	• Visual • Exercise equipment • Check contacts and equipment • Oil sample	• Electronic documents • Lab reports	• Job orders • Cascade

Biweekly inspections include:

- Oil leaks
- Status of breaker, control, and recloser
- Verify trip air pressure and check for leaks
- Veeder counts
- Check over compressor, drain water, and check pressures
- Accumulator pressure and hydraulic pressure
- Confirm proper pressure in all SF6 equipment

Annual inspections and maintenance include:

- Oil sample for dielectric, color, and acidity
- Check and maintain pneumatic systems, and verify limits and proper operation

Inspections done every five years include:

- Check contacts; maintain and adjust for proper operation
- External visual inspection to check for:
 - Connections
 - Conditions
 - Oil level and seals
 - Ground connection
 - Breaker foundation
- Internal visual inspection to check for:
 - Loose connections
 - Corrosion
 - Broken seals
 - Worn linkage
- Contact replacement as needed
- Oil sample for dielectric, color, and acidity
- Filter oil
- Operate breaker trip mechanism and verify travel and operation
- Operate breaker control operation

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Switches

Interval	Description	Inspection	Correction
Biweekly	• Visual	• Exception report	• Exception report • Cascade
Annual	• Visual • Thermal imaging	• Electronic documents	• Job orders • Cascade

Biweekly inspections include:

- Visual inspection of switch components to check for any damage

Annual inspections and maintenance include:

- Check the switches using thermal imaging

Bus Work

Interval	Description	Inspection	Correction
Biweekly	• Visual	• Exception report	• Exception report • Cascade
Annual	• Visual • Thermal imaging	• Electronic documents	• Job orders • Cascade

Biweekly inspections include:

- Visual inspection to check for any damage

Annual inspection and maintenance includes the following:

- Scan bus work and structures with thermal imaging to check for overheating

Emergency Generators

Interval	Description	Inspection	Correction
Biweekly	• Visual	• Exception report	• Exception report • Cascade
Annual	• Exercise equipment • Battery check • Oil, filters, and valves	• Electronic documents	• Job orders • Cascade

Biweekly inspections include:

- Visual inspection of generators and batteries to check for leaks, corrosion, and structural damage
- Check fluid levels

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Annual inspections and maintenance include:

- Operate the generators monthly
- Check moving parts and lube
- Change oil and filter
- Check and clean all other filters and valves
- Check:
 - Cell impedances
 - Cell voltages
 - Specific gravities
 - Cell-to-cell strap resistances
- Check and maintain connection points

Relays

Interval	Description	Inspection	Correction
Biweekly	• Procedures and guidelines are included in the SMS.	• Exception report	• Exception report • Cascade
5 Years	• Procedures and guidelines are included in the SMS.	• Electronic documents	• Job orders • Cascade
As needed	• Check coaxial cable	• Electronic documents	• Cascade

Procedures for specific relays are found in Section 1100 in the SMS. A summary of relays and test methods currently in use is included in Appendix C.

The following are general guidelines that apply to all relays.

Biweekly inspections include:

- Visual inspection to make sure covers are seated
- Check, record, and reset any targets

Five-year testing includes the following:

- Perform functional tests of electromechanical relays including backup and tap changing relays
- Test electronic relays using internal testing
- Check for loose wiring
- Verify and set line drop compensation
- Test all relays associated with transfer switches and generators where applicable

Additional testing includes the following:

- Check coaxial cable insulation condition
- Check shield-to-ground resistance

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Reclosers

Interval	Description	Inspection	Correction
Biweekly	• Visual	• Exception report	• Exception report • Cascade
5 Years	• Visual • Exercise equipment • Oil sample • Filter oil	• Electronic documents • Lab reports	• Job orders • Cascade
As needed	• Visual • Check contact • Check pickup coil	• Electronic documents	• Job orders • Cascade

Biweekly inspections include:

- Visual inspection to check recloser, bushings, and remove accumulated debris
- Check recloser status and mode
- Check for fluid leaks and oil level
- Check veeder counts

Five-year inspection and maintenance includes the following:

- External visual inspection
- Operate recloser to check for:
 - Proper operation and control
 - Timing
 - Adjust settings as needed
- Oil sample dielectric, color, acidity testing
- Filter oil

Additional tests include:

- Internal visual inspection to check internals for wear and stress
- Check contact resistance
- Verify recloser pickup coil settings
- Wipe down and check porcelain for any damage

At present, hydraulic reclosers are not inspected on a multi-weekly cycle. Maintenance is done every five years.

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Regulators

Interval	Description	Inspection	Correction
Biweekly	• Visual	• Exception report	• Exception report • Cascade
5 Years	• Visual (external) • Oil sample • Filter oil	• Electronic documents • Lab reports	• Job orders • Cascade
As needed	• Visual (internal) • Check turns ratios	• Electronic documents	• Job orders • Cascade

Biweekly inspections include:

- Visual inspection to check for damage or debris
- Check regulator status
- Check for fluid leaks

Five-year inspection and maintenance includes the following:

- External visual inspection to check for:
 - Connections and condition
 - Flange seal
 - Ground connections
 - Foundation
- Oil sample for dielectric, color, and acidity test
- Filter oil

Additional tests include:

- Internal visual inspection of connections and condition, seals and loose debris in tank
- Turns ratio through all tap positions when transformer is commissioned and when tap position changes
- Porcelain check including wipe down

Capacitors

Interval	Description	Inspection	Correction
Biweekly	• Visual	• Exception report	• Exception report • Cascade
5 Years	• Visual (external) • Oil sample • Filter oil	• Electronic documents • Lab reports	• Job orders • Cascade
As needed	• Visual (internal) • Check turns ratios	• Electronic documents	• Job orders • Cascade

Biweekly inspections include:

- Visual inspection to check for damage or debris
- Check regulator status
- Check for fluid leaks

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Five-year inspection and maintenance includes the following:

- External visual inspection to check for:
 - Connections and condition
 - Flange seal
 - Ground connections
 - Foundation
- Oil sample for dielectric, color, and acidity test
- Filter oil

Additional tests include:

- Internal visual inspection of connections and condition, seals and loose debris in tank
- Turns ratio through all tap positions when transformer is commissioned and when tap position changes
- Porcelain check including wipe down

Grounding System

Interval	Description	Inspection	Correction
Biweekly	• Visual	• Exception report	• Exception report • Cascade
Annual	• Ground resistance measurement • Ground rod check	• Electronic documents	• Job orders • Cascade

Biweekly inspections include:

- Visual inspection of connections and conditions

Annual inspections and maintenance include:

- Measure and plot ground resistance for the grid when the substation is commissioned or when there is damage
- Inspect accessible ground rods and redrive rods where needed

Communication Systems

Interval	Description	Inspection	Correction
Annual	• Relay operation and settings • Replace RTU standby batteries	• Electronic documents	• Job orders • Cascade

Annual inspections and maintenance include:

- Verify relay operation for communication
- Verify and change relay settings when needed
- Replace and recycle standby batteries in RTU

Others Areas of Inspection and Maintenance

Tree Trimming

PSC 113 requires that the transmission and distribution systems be inspected for the presence of power line natural hazards every three to eight years.

- Trees on the electric system are presently trimmed on a 5-1/2 year cycle.
- Potential tree-related problems are noted upon discovery during system patrols.
- Hazards to our facilities are cleared as soon as possible.
- Trees that present a future hazard are cleared as work permits, with oak pruning occurring between November through March.
- Emergency trimming is done as needed. Determination of need is based on observation by field personnel or reports by citizens.

Cathodic Protection

Inspection and maintenance of the cathodic protection system on high-pressure, oil-filled equipment and facilities is performed semiannually. There are multiple inspections involved on varying cycles. Results of the inspections and any recommendations are summarized in a semiannual report. These reports are kept in Corporate Records.

Safety Equipment and Tools

Rubber goods used for safety include gloves and sleeves, hoses and blankets. These items are exchanged, cleaned, and tested on a two-month cycle. Doing so ensures these items will perform as expected and are in excellent condition.

Hot sticks are used by crews when working with equipment in the system. Hot sticks are cleaned regularly according to OSHA standards.

Miscellaneous tools and equipment used by crews in the field are cleaned and maintained by the crews as work.

Line truck buckets and booms undergo dielectric testing yearly. Booms on line trucks are load-tested annually. Trucks over 26,000 pounds get a pre-ride and a post-ride check daily.

Appendixes

Appendix A - Underground High-Voltage Distribution Facilities

Underground High-Voltage Distribution Line Patrol Report Form

Appendix B - Wood High-Voltage Distribution Poles

High-Voltage Distribution Wood Pole Inspection Checklist

Appendix C - Substation

Index of Substation Maintenance Standards

Summary of Relays and Tests in Use

Appendix D - Underground Distribution Equipment

Switch Cabinet Inspection Report Form

Underground Residential Distribution (URD) Inspection Report Form

Dead Front Pad-Mount Cabinet Inspection Form

Appendix E - Distribution Network and Customer-owned Vaults

AC Network Vault Equipment Report Form

Customer-Owned Transformer/Enclosure Inspection Report Form

Appendix F - Overhead Switches

Overhead Switch Checklist Form

Appendix G - Overhead Capacitor Banks

Distribution Capacitor Bank Inspection Procedures

Appendix H - Overhead Distribution Poles

Distribution Pole Inspection Checklist

Appendix I - Electric Meter Shop Inspection Forms

Substation Inspection Checklist for Biweekly Inspections

ME Line Recloser Inspection Report Form

S&C Automatic Transfer Switchgear Inspection Form

Voltage Regulator Inspection Report Form

Appendix J - Safety-Related Documents

Rubber Goods Exchange Memo

Driver's Vehicle Condition Report

Gasoline or Limited Duty Diesel Powered Vehicle Inspection

Appendix A

Underground High-Voltage Distribution Facilities



69-kV UNDERGROUND HIGH VOLTAGE DISTRIBUTION LINE PATROL REPORT

Note: These transmission lines should be walked in areas not accessible by vehicular traffic. These reports are due at 8:00 a.m. the day following the patrol date.

Transmission Line Patrolled

Patrolled by

Date

Time

Existing Conditions (give location and description)

New Construction	<input type="checkbox"/> None		
Old Construction (previously reported)	<input type="checkbox"/> None		
Dead Trees, Grass and Shrubs	<input type="checkbox"/> None		
Sunken Ground Crack in Road	<input type="checkbox"/> None		
Manhole Covers	<input type="checkbox"/> In Place <input type="checkbox"/> Missing <input type="checkbox"/> Ajar <input type="checkbox"/> Other (broken, etc.)		
Signs	Underground High Voltage	<input type="checkbox"/> OK	
	Road or Creek Crossing	<input type="checkbox"/> OK	
Miscellaneous Conditions			
Riser Structures		Beginning	Ending
	Poles		
	Riser Pipes		
	Potheads		
	Ground Wire		
	Hardware		
	Insulators		
	Conductor		
Sub- Stations	Fences and Locks		
	General Appearance		

Appendix B

Wood High-Voltage Distribution Poles

WOOD HIGH-VOLTAGE DISTRIBUTION POLE INSPECTION CHECKLIST

✓	ITEMS				
	Inspector:	Date:			
	Pole No.:				
	Manufacturer:				
	Year Installed:				
	Hgt. Class:				
	Miscellaneous Codes:				
	Insects:				
	Inspection Types:				
	Species:				
	Treatment:				
	Wood Pole Descr.:				
	Aboveground Line Decay:				
	Belowground Line Decay:				
	Previous Cycle:				
	Maintenance Conditions				
	Miscellaneous Remarks:				
	MITC Fume (No. vials of insecticide):				
	Internal Treat:				
	Private Property:				
	Ground Wire Molding:				
	Danger Sign:				
	Overall Condition:	1	2	3	4
Comments:					

Appendix C

Substation

Substation Maintenance Standards

Subject

Table of Contents

*Date Issued
or Revised*

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00	Table of Contents	
100	General Safety	
200	Environmental Concerns	12/09/94
300	Station Batteries and Racks	12/09/94
400	Station Battery Chargers	12/09/94
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800	Switches	12/09/94
900	Buss Work	12/09/94
1000	Emergency Generators	12/09/94
1100	Relays	12/09/94
	<i>Relay Test Procedure (RTP):</i>	
1101	Balser BE-1-32 Relay	12/09/94
1102	Fitchburg Automatic Transfer Switch	12/09/94
1103	Fitchburg DC Alarms	12/09/94
1104	Fitchburg Lockout Relays	12/09/94
1105	General Electric ACR Recloser	12/09/94
1106	General Electric BDD Relay	12/09/94
1107	General Electric GCX Relay	12/09/94
1108	General Electric IAC Relay	12/09/94
1109	General Electric IBC Relay	12/09/94
1110	General Electric IBCG Relay	12/09/94
1111	General Electric IJS Relay	12/09/94
1112	General Electric JBCG 53 and 63 Relays	12/09/94
1113	General Electric NAA Relay (Style 12NAA27AD1A)	12/09/94
1114	General Electric NAA Relay (Style 12NAA27M16A Only)	12/09/94
1115	General Electric PJC Relay	12/09/94
1116	General Electric RPM Relay	12/09/94
1117	General Electric SAM Relay	12/09/94
1118	General Electric SBA Relay	12/09/94
1119	NSP-DC Power Supply Alarm	12/09/94
1120	NSP Lockout Relays	12/09/94

1121	RIS Relay	12/09/94
1122	West Middleton Lockout Relays - 138KV	12/09/94
1123	Westinghouse AR Relay	12/09/94
1124	Westinghouse BL1 Thermal Relay	12/09/94
1125	Westinghouse CA-% Differential Relay	12/09/94
1126	Westinghouse CA-16 Relay	12/09/94
1127	Westinghouse CN-33 Network Protector	12/09/94
1128	Westinghouse CO Relay	12/09/94
1129	Westinghouse H3 Relay	12/09/94
1130	Westinghouse IRD-8 Relay	12/09/94
1131	Westinghouse IRQ-9 Relay	12/09/94
1132	Westinghouse IRV-8 Relay	12/09/94
1133	Westinghouse ITE 62T Relay	12/09/94
1134	Westinghouse ITH Relay	12/09/94
1135	Westinghouse KC-2 Relay	12/09/94
1136	Westinghouse KC-4 Relay	12/09/94
1137	Westinghouse KD-4, KD-10, KD-11 and KD-41 Relays	12/09/94
1138	Westinghouse KF Relay	12/09/94
1139	Westinghouse KH-2 Relay	12/09/94
1140	Westinghouse MG-6 Relay	12/09/94
1141	Westinghouse PUF-59 Relay	12/09/94
1142	Westinghouse RC Relay	12/09/94
1143	Westinghouse SG Relay	12/09/94
1144	Westinghouse SGR-52 Relay	12/09/94
1145	Westinghouse SKB Relay	12/09/94
1146	Westinghouse SX Relay	12/09/94
1147	Westinghouse TD-4 Relay	12/09/94
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◆ ◆ ◆

Relay Summary Types and Tests

ALL RELAYS

Functional testing

Electromechanical, including

Beckwith backup

Tap-changing relays on transformer

Use self testing in the relays where available.

Check for loose connections in the control wiring.

Verify and set the line drop compensation.

Test relays associated with transfer switches and generators where applicable.

Change relay settings as required by engineering.

TEST EQUIPMENT USED

- Epoch 1
- TV2
- Relay test can
- Meters as needed for impedance, voltage and current
- Slide in test jacks
- Resistors and testers

TYPES OF RELAYS

- Overcurrent
 - Phase directional overcurrent
 - Ground directional overcurrent
 - Instantaneous overcurrent
 - Ground directional overcurrent negative sequence
 - High speed overcurrent
- Differential
 - Transformer
 - Buss
 - Percent differential
- Synch-check
- Distance
- Frequency
 - Under frequency
- Auxiliary
 - Transfer trip
- Reclosing
- Thermal
- Timing
- Power
- Voltage

TESTS FOR RELAY TYPES

- Overcurrent
 - Overcurrent pickup
 - Overcurrent timing
 - Instantaneous pickup
 - Target pickup

- Target dropout
- Directional pickup
- Directional current pickup
- Directional voltage
- Time target pickup
- Instantaneous target
- Tap pickup
- Time curve
- Contact pickup
- Instantaneous over current pickup
- Negative sequence voltage filter adjustment
- Negative sequence current filter adjustment

- Differential
 - Tap pickup
 - Slope
 - Harmonic restraint
 - Instantaneous target pickup
 - Minimum pickup
 - Percent differential
 - Time curve
 - Target pickup
 - Fault detector
 - Pickup
 - Through fault
 - Percent slope
- Synch-check
 - Closing angle
 - Timing
 - Telephone relay
- Distance
 - Full functional
 - Setting
 - Meter
 - Mho unit
 - Directional element
 - Residual overcurrent
 - Residual time-overcurrent timing
 - Phase overcurrent
 - Loss-of-potential
 - DG and DP timer tests
 - Remote end just open
 - Switch onto faults
 - Recloser
 - Synchronizing and polarizing voltage
 - Voltage checking logic
 - Synchronism checking logic
 - Input circuits
 - Serial ports
 - Time code input
 - Power supply voltage
 - Three phase reach
 - Three phase angle of max torque

Relay Summary Types and Tests

- Phase to phase reach
 - Phase to phase angle max torque
 - Target pickup
 - Mho unit spring adjustment
 - Ohmic reach test
 - Angle of max torque
 - Ohm unit spring adjustment and reach test

 - Frequency
 - Frequency trip
 - Telephone relay
 - Target pickup
 - Frequency and timing
 - Under voltage dropout

 - Auxiliary
 - Unit test
 - Opening test
 - Coil pickup

 - Reclosing
 - Timing
 - Pickup timing delay
 - Pickup
 - Reset
 - Reset timing
 - Reclose timing

 - Thermal
 - Overload
 - Preload
 - Instantaneous
 - Instantaneous target
 - Time target pickup

 - Timing
 - Telephone relay pickup
 - Timing
 - Target pickup

 - Power
 - Relay pickup
 - Relay timing
 - Target pickup

 - Voltage
 - Under voltage pickup
 - Timing under voltage
 - Target pickup
-

Appendix D

Underground Distribution Equipment



SWITCH CABINET INSPECTION REPORT

Type	Overall Condition: 1 2 3 4			Map Location Number	
Primary Cable	Open	Close	Blades	Fuse	Fuse Size
AØ to					
BØ to					
CØ to					
AØ to					
BØ to					
CØ to					
AØ to					
BØ to					
CØ to					
AØ to					
BØ to					
CØ to					
	Yes	No	Comments		
Has Fault Indicators					
Needs Leveling					
Needs Raising/Lowering					
Needs Painting					
Needs Protective Posts					
Ground Sleeve O.K.					
Adequate Operating Clearance					
Remarks					
<hr/> <hr/> <hr/> <hr/>					
Inspected by				Date	

URD PADMOUNT TRANSFORMER INSPECTION

Inspected by: _____ Date inspected: _____

Overall condition: ____1 ____ 2 ____ 3 ____ 4

Map/pole: _____ Size KVA: _____ Make: _____ Serial #: _____

Primary: _____ Taps: _____ 3 Phase: _____

Secondary: _____ Impedance: _____ 1 Phase: _____ Phase: _____

Next Structure A Phase

Next Structure B Phase

Next Structure C Phase

	Map	Pole	Open Ckt
1		-	
2		-	

	Map	Pole	Open Ckt
1		-	
2		-	

	Map	Pole	Open Ckt
1		-	
2		-	

Paint OK			
Posts OK			
Cable Marked			
Signs OK			
Clearance OK			
Setting OK			
No Leaks			
Cables OK			
Dbl Locked			
Other OK			
Cabinet OK			

Remarks:

DEAD FRONT PADMOUNT CABINET INSPECTION

Type: _____ Num Pos: _____ Map: _____ Pole: _____ Date Insp: _____
 Insp. by: _____

3 Phase: _____ 1 Phase: _____ Phase: _____ Overall condition: 1 2 3 4

PHASE CONNECTIONS

A TO 1	<input type="checkbox"/>	B TO 1	<input type="checkbox"/>	C TO 1	<input type="checkbox"/>	A TO 1 OC	<input type="checkbox"/>	B TO 1 OC	<input type="checkbox"/>	C TO 1 OC	<input type="checkbox"/>
A TO 2	<input type="checkbox"/>	B TO 2	<input type="checkbox"/>	C TO 2	<input type="checkbox"/>	A TO 2 OC	<input type="checkbox"/>	B TO 2 OC	<input type="checkbox"/>	C TO 2 OC	<input type="checkbox"/>
A TO 3	<input type="checkbox"/>	B TO 3	<input type="checkbox"/>	C TO 3	<input type="checkbox"/>	A TO 3 OC	<input type="checkbox"/>	B TO 3 OC	<input type="checkbox"/>	C TO 3 OC	<input type="checkbox"/>
A TO 4	<input type="checkbox"/>	B TO 4	<input type="checkbox"/>	C TO 4	<input type="checkbox"/>	A TO 4 OC	<input type="checkbox"/>	B TO 4 OC	<input type="checkbox"/>	C TO 4 OC	<input type="checkbox"/>
A TO 5	<input type="checkbox"/>	B TO 5	<input type="checkbox"/>	C TO 5	<input type="checkbox"/>	A TO 5 OC	<input type="checkbox"/>	B TO 5 OC	<input type="checkbox"/>	C TO 5 OC	<input type="checkbox"/>

A FUSE 1	<input type="checkbox"/>	B FUSE 1	<input type="checkbox"/>	C FUSE 1	<input type="checkbox"/>
A FUSE 2	<input type="checkbox"/>	B FUSE 2	<input type="checkbox"/>	C FUSE 2	<input type="checkbox"/>
A FUSE 3	<input type="checkbox"/>	B FUSE 3	<input type="checkbox"/>	C FUSE 3	<input type="checkbox"/>
A FUSE 4	<input type="checkbox"/>	B FUSE 4	<input type="checkbox"/>	C FUSE 4	<input type="checkbox"/>
A FUSE 5	<input type="checkbox"/>	B FUSE 5	<input type="checkbox"/>	C FUSE 5	<input type="checkbox"/>

Y/N		COMMENT	DATE DONE
Arrestors	<input type="checkbox"/>		
Level	<input type="checkbox"/>		
Raise/low	<input type="checkbox"/>		
Paint	<input type="checkbox"/>		
PR Post	<input type="checkbox"/>		
Warning Sign	<input type="checkbox"/>		
Cables Marked	<input type="checkbox"/>		
Fits Pad	<input type="checkbox"/>		
Lube Hinge	<input type="checkbox"/>		
Clearance	<input type="checkbox"/>		
Other	<input type="checkbox"/>		
Dbl Lock	<input type="checkbox"/>		
Set OK	<input type="checkbox"/>		
No Leak	<input type="checkbox"/>		
Cab Condition	<input type="checkbox"/>		

Remarks:

Appendix E

Distribution Network and Customer-Owned Vaults



A.C. NETWORK EQUIPMENT VAULT INSPECTION REPORT

Location

Feeder No.

Date	Time	Protector							Transformer							Remarks	Inspector	Overall Condition
		Open	Closed	Veeder After Reading	Manual Position		Case Open	Temp.		Disconnect Position			Oil Level					
					Open	Auto		Closed	Max	Reset	Open	Closed	Ground	Switch	Transf.			
																		1 2 3 4
																		1 2 3 4
																		1 2 3 4
																		1 2 3 4
																		1 2 3 4
																		1 2 3 4
																		1 2 3 4
																		1 2 3 4
																		1 2 3 4
																		1 2 3 4

Customer Owned Transformer/Enclosure Inspections

Address _____

Map Number _____

Customer _____

Inspection Date _____ By _____

Vault Y N Enclosure Y N

Primary Service Condition _____

Transformer Condition _____

Secondary Service Condition _____

Vault/Enclosure Condition _____

Doors/Locks/Fence Condition _____

Vault Lighting _____

Danger High Voltage Signs _____

Do Not Enter sign _____

French drain -----Yes _____ No _____

If Yes, has it been concreted closed Yes _____ No _____

Miscellaneous Comments _____

Overall Condition : 1 2 3 4

Appendix F

Overhead Switches

OVERHEAD SWITCH CHECKLIST

✓	ITEMS			
	Inspector Name:		Date:	
	Switch No.:			
	Address:			
	Pole No.:			
	Manufacturer:			
	Model No.:			
	Circuit:			
	Insulator post	<input type="checkbox"/> OK	<input type="checkbox"/> Bad Phase: <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C Problem: Fixed: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Insulator suspension	<input type="checkbox"/> OK	<input type="checkbox"/> Bad Phase: <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C Problem: Fixed: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Contacts	<input type="checkbox"/> OK	<input type="checkbox"/> Bad Phase: <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C Problem: Fixed: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Jumpers	<input type="checkbox"/> OK	<input type="checkbox"/> Bad Phase: <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C Problem: Fixed: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Handles and pipes	<input type="checkbox"/> OK	<input type="checkbox"/> Bad Phase: <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C Problem: Fixed: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Overall condition		1	2 3 4
Comments:				

Appendix G

Overhead Capacitor Banks

Distribution Capacitor Bank Inspection Procedures

Completed annually and during the year as necessary

Fixed, Half-Switched, or Switched Capacitor Banks

- Check for blown fuses or arresters.
- Check for ruptured units.
- Check for leaking units.
- Check for damage by wildlife (chewed equipment/wires, bird/squirrel nests)
- Check control box (if applicable) for external damage.
- Check whether fuses are removed, for seasonal banks from September to May when loads are lower.
- Check records as to location, voltage, circuit, phases, trip/close status, seasonal, size, number, type (fixed, half-switched, switched) and current-sensing phase (if applicable).
- Record and describe any visible damaged equipment or extraordinary configurations.

Half-Switched Capacitors / Switched Capacitors (Current-Controlled or Voltage-Controlled)

- Check records as to control mode (manual, current, voltage).
- Determine whether the bank is closed or tripped via visual inspection of the oil switches.
- Check to ensure that the sensor for any current-controlled bank is downstream of the substation.
- Open control box and inspect internal conditions for damage or physical degradation.
- Record the value of the operations counter.
- Compare existing control settings (voltage or current) to previous records.
- Ensure that a spare fuse is available in the control box.

- Verify switch and control operation
- Record problems (blown control fuses, switch misoperations, on/off times less than 60 seconds, counter miscounts, swings in current, dramatic or null voltage changes).

Report problems to Electric Operations.

Appendix H

Overhead Distribution Poles

POLE CHECKLIST

✓	ITEMS			
	Inspector:			Date:
	Pole No.:			
	Pole condition above ground	<input type="checkbox"/> OK	<input type="checkbox"/> Poor	<input type="checkbox"/> Further Inspection Needed
	Pole condition below ground	<input type="checkbox"/> OK	<input type="checkbox"/> Poor	<input type="checkbox"/> Rotten
	Crossarms	<input type="checkbox"/> OK	<input type="checkbox"/> Poor	<input type="checkbox"/> None
	Braces	<input type="checkbox"/> OK	<input type="checkbox"/> Broken/Detached	<input type="checkbox"/> None
	Insulators	<input type="checkbox"/> OK	<input type="checkbox"/> Broken	<input type="checkbox"/> None
	Lightning arrestors	<input type="checkbox"/> OK	<input type="checkbox"/> Blown	<input type="checkbox"/> None
	Ground wire molding	<input type="checkbox"/> OK	<input type="checkbox"/> Replaced	<input type="checkbox"/> None
	Guy wire shields	<input type="checkbox"/> OK	<input type="checkbox"/> Replaced	<input type="checkbox"/> None
	High-voltage signs	<input type="checkbox"/> OK	<input type="checkbox"/> Replaced	<input type="checkbox"/> None
	Pole tags	<input type="checkbox"/> OK	<input type="checkbox"/> Missing	
	Cable TV attached?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
	Phone wires attached?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
	Overall condition			1 2 3 4
Comments:				

Appendix I

Electric Meter Shop Inspection Forms

Substation Inspection Checklist for the Biweekly Inspections (Inspections done by the Electric Meter Shop)

Reporting Method for the Electric Meter Shop

The following checklist is to be used for determining abnormal items (exceptions). These are reported one of two ways:

All exceptions are logged into a spreadsheet (called "exception.xls" on the engineering network) to be evaluated by Substation Maintenance for follow-up.

All critical items that need Immediate Response are reported to the Substation Maintenance Supervisor.

The Bi-weekly Inspection Checklist

Station Batteries and Associated Equipment

- ☐ Overall visual inspection of batteries and associated equipment checking for deterioration.
- ☐ Electrolyte fluid level and leaks. (Including sediment and corrosion)
- ☐ Check battery charger currents and grounds.

Power Transformers

- ☐ Nitrogen gas pressure checks.
- ☐ Gas and oil leaks. (Gas blowing / hissing)
- ☐ Oil level and temperature check.
- ☐ Winding temperature. (TRO)
- ☐ Cooling fan status.
- ☐ Oil circulating pump status. (on automatic)
- ☐ Porcelain condition.
- ☐ Desiccant filter condition. (Purple is good, Pink is bad)
- ☐ Compartment heaters.

Load Tap Changers

- ☐ Check for oil level, oil leaks and gas leaks. (Gas blowing / hissing)
- ☐ Veeder count (number of operations).
- ☐ Tap position and range, resetting drag hands as applicable.
- ☐ Control setting and mode. (on automatic)
- ☐ Compartment heaters.

Power Circuit Breakers

- ☐ Oil leaks.
- ☐ Status of breaker, control and recloser. (supervisory or manual)
- ☐ Verify trip air pressure and check for leaks. (spring or air charged)
- ☐ Veeder counts. (operations)
- ☐ Check over compressor, drain water and check pressures.
- ☐ Accumulator pressure and hydraulic pressure.
- ☐ Confirm proper pressure in all SF6 equipment.
- ☐ Porcelain condition

Substation Inspection Checklist for the Biweekly Inspections (Inspections done by the Electric Meter Shop)

Disconnect Switches

- ☐ Visual inspection of switch components checking for any damage, positive and proper seating (flush), and no obstructions.
- ☐ Check for broken insulators.

Bus Work

- ☐ Visual inspection checking for any damage.
- ☐ Check for broken insulators.

Emergency Generators

- ☐ Visual inspection of generators and batteries checking for leaks, corrosion, and structural damage.
- ☐ Check fluid levels.

Relays - General

The following are general guidelines that apply to all relays.

- ☐ Visual inspection making sure covers are seated.
- ☐ Check, record and reset any targets.

Reclosers

- ☐ Visual inspection to check recloser, bushings and remove accumulated debris.
- ☐ Check recloser status and mode.
- ☐ Check for fluid leaks and oil level. (Check DC Battery)
- ☐ Check Veeder counts. (Record in log book)

Regulators

- ☐ Visual inspection to check for damage or debris.
- ☐ Check regulator status.
- ☐ Check for fluid leaks.

Capacitors

- ☐ Visual inspection to check fusing, damage and for debris.
- ☐ Check for fluid leaks. (read Veeder count and record in log book)

Grounding System

- ☐ Visual inspection of connections and conditions. (if they can be seen)

Miscellaneous Items

- ☐ Cathodic Protection – check for oil leaks and fusing
- ☐ Replace burnt out lamps
- ☐ Fire extinguisher check
- ☐ Security check – Fencing, gates and locks
- ☐ Check auto transfer switch for station service
- ☐ Check auto transfer S&C gear for ready light, general condition and Veeder counts (record in log at the site)
- ☐ BGS (Backup Generation Service) units inspect using the “Generator Inspection Checklist”.



M.E. LINE RECLOSER INSPECTION

Date

Location	Phase Resistor	% of Ø Resistor			Veeder Count	Ops.	Batt. Volts	Targets and Comments	By
		A%	B%	C%					
Bronner at Airport Road	*	43 51	42 50	41 49					
Lodi Springfield at Woodland	200A								
Hwy K East of Hwy 12 Ashton Corners	*	43 51	42 50	41 49					
Hwy. M at Mendota Co. Park East of Hwy. Q	*	41 49	42 50	43 51					
Pheasant Branch 1321	560A								
Pheasant Branch 1322	560A								
Seminole Hwy. at R.R.	400A								
Seminole Hwy. at Lacy	400A								
McKee Road	400A								
Fish Hatchery Rd. South of Lacy	*	41 49	42 50	43 51					
Larsen Road	400A								
Femrite Drive	280A								
Gateway Sub	400A								
Sycamore Ave. at N. Thompson	400A								
Anderson St. at MATC	400A								
Pierstorff St.	400A								
Hwy. 51 at Hanson	200A								
Mendota Sub.	400A								
Wheeler Road	400A								
Hwy. M & Willow Road	400A								

*The microprocessor controls give readings in amps. Items 41-43 are instantaneous phase currents. Items 49-51 are maximum 15 minute average phase currents and are reset individually with the CLEAR key. Use the CLEAR key to reset any targets.



S & C AUTOMATIC TRANSFER SWITCHGEAR INSPECTION

Date _____

Address/Customer	Map-Pole Number	Type	Owner	READY Light On*	Switch Numbers	Veeder Count	Operations since last inspection	Comments	By
1313 John Q Hammons St. Marriott, Madison West	16Y9-C1	Pad-mount	MGE		1604				
					259 N.O.				
1313 John Q Hammons St. Marriott, Madison West	16Y9-C2	Pad-mount	MGE		507				
					1181 N.O.				
8200 Hwy. 14 (@ Deming Way) City of Middleton Lift Station	16Y1-D1	Pad-mount	MGE		1321				
					1333 N.O.				
5910 Mineral Point Rd. CUNA (Computer Support Facility CSF)	19H8-G25	Vault	MGE		1169				
					1028 N.O.				
					1273				
707 S. Mills St. St. Mary's Hospital	216-B20	Vault	Customer		1800				
					1569 N.O.				
					1622				
202 S. Park St. Meriter Park Hospital (Chandler St. end)	116-	Out-door	Customer		1593				
					1737 N.O.				
					1628				
202 S. Park St. Meriter Park Hospital (Basement Atrium Addition)	122-	Vault	Customer		1835				
					1783 N.O.				
115 W. Doty St. Dane County (PSB)	104-G4	Vault	MGE		1585				
					1666 N.O.				
1 John Nolen Drive Monona Terrace Conv.	4 - M2	Vault	MGE		1681				
					1906 N.O.				
302 N. Walbridge Ave. American Family Insurance	27Y2-	Out-door	Customer		1310				
					Tie N.O.				
					1312				
3550 Anderson St. MATC - Truax	26JT5-	Vault	Customer		To 582				
					Tie N.O.				
					To 975				
2401 International Lane Great Lakes Higher Ed.	25JT3 -G24	Pad-mount	MGE		391				
					1725 N.O.				
4000 International Lane Airport Terminal	25K13 -A27	Pad-mount	MGE		Right SW				
					Left SW N.O.				
3400 E. Washington Avenue Gardner Baking Company	26J5 -J25	Pad-mount	MGE		Right SW N.O.				
					Left SW				
Spring St. @ N. Park St. Storm water pump site	121- A33	Pad-mount	MGE		Right SW N.O.				
					Left SW				

* If READY light is not on, see back for list of possible reasons.

CONDITIONS REQUIRED FOR THE READY LIGHT

Manual/automatic selector switch in AUTOMATIC.

Both source voltages are good.

Alternate source switch or bus tie switch is open. The normal source(s) switch is closed.

Switch operators are charged and coupled to switches.

Switch compartment doors are closed and latched.

Overcurrent LOCKOUT is reset (if the switchgear has this option).

Key interlocks are unlocked (if the switchgear has interlocks).

Voltage unbalance detection feature is on (if the switchgear has this option).



VOLTAGE REGULATOR INSPECTION REPORT

Date _____

Time _____

Voltage Regulator Installation:

- ☐ Wheeler Rd. west of Packers Ave.
☐ Cross Plains Substation
☐ Milwaukee St. east of I90
☐ Other _____

	A-Phase	B-Phase	C-Phase
Tap Changer position	_____	_____	_____
Tap Changer range (DRAG HANDS RESET)	_____	_____	_____
OPERATION COUNTER Reading	_____	_____	_____
# of operations since last reading on _/_/_	_____	_____	_____
<u>Terminal VOLTAGE TEST</u>	V	V	V
NORMAL Voltage Source & AUTO Operation	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
<u>SYSTEM STATUS</u>			
WATCHDOG light flashing (Normally yes)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
RPF (Reverse Power Flow) light on*	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
ALERT light on	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
BAND INDICATOR	High/In/Low	High/In/Low	High/In/Low
<u>DATA/PAK Digital Display</u>			
ALERT	_____	_____	_____
ALERT (After pressing reset button on side of panel)	_____	_____	_____
Current Load Information			
AMPS*	_____	_____	_____
PF (Power Factor)	<input type="checkbox"/> lead <input type="checkbox"/> lag	<input type="checkbox"/> lead <input type="checkbox"/> lag	<input type="checkbox"/> lead <input type="checkbox"/> lag
VOLTS	_____	_____	_____
COMP VOLTS	_____	_____	_____
DRAG HANDS Readings of Load Extremes	<input type="checkbox"/> lead	<input type="checkbox"/> lead	<input type="checkbox"/> lead
LAG PF (Most lagging power factor)	<input type="checkbox"/> lag	<input type="checkbox"/> lag	<input type="checkbox"/> lag
LEAD PF (Most leading power factor)	<input type="checkbox"/> lead <input type="checkbox"/> lag	<input type="checkbox"/> lead <input type="checkbox"/> lag	<input type="checkbox"/> lead <input type="checkbox"/> lag
MAX AMP (Maximum load current)*	_____	_____	_____
HIGH VOLT (Highest output voltage)	_____	_____	_____
LOW VOLT (Lowest output voltage)	_____	_____	_____

(Reset button is located on top of the DATA/PAK. Each DRAG HANDS reading must be reset individually.)

General Condition: _____

Inspection by: _____

*During reverse power flow, the load current readings can be in error by as much as 10% because the current transformer is then located on the source side.

Appendix J

Safety-Related Documents

COPY

Materials Management

MEMORANDUM

DATE: November 15, 2000

TO: Pat Baldwin
Doug Bufton
Larry Capps
Dale Freiman
Rick Jilot

Al Mickelson(Forms)
Don Pierstorff (Forms)
Dick Schwarz
Dennis Steinhorst

FROM: John Capacio *qu*
Jerry Peplinski *JP*

SUBJECT: Rubber Goods Exchange

Please inform all concerned personnel that the exchange of rubber goods is scheduled for the week of *November 20, 2000*. ETD staff will exchange their rubber goods at the Stores service counter in the Central Service Center. Electric Production, Meter and Connection, and Electric Meter Shop personnel will exchange their rubber goods at the Service building.

ETD Personnel

Attached are the Rubber Goods Exchange Forms for ETD staff. The truck assignments came from the ETD Crew List of the Week of November 20, 2000. The glove and sleeve sizes for ETD personnel and trucks came from data recorded from previous rubber goods exchanges. Rubber, mitts and other items such as leather shields for 20kV gloves and 1kV gloves, sleeve buttons, glove powder, etc. are available from the Storeroom. **Please note: There are no requisitions for ETD supervisory personnel for this exchange.** If you need to exchange your gloves, please do so at the CSC Storeroom.

For ETD personnel who are on vacation this week and report to the CSC, please hold the form until they return and have them exchange their rubber goods at the Stores service counter. **If they report to Fitchburg, Cross Plains, or Job Site, have them complete the form and send it to Stores.** Stores will arrange to deliver their new rubber goods and pick up their old rubber goods.

For all other ETD personnel, have the crew leader confirm the size information for gloves and sleeves. Turn the form in to the Storeroom. Stores personnel will fill each request during the week. Stores personnel will place the requested items in a tote and place the tote next to the vehicle. ETD crews will remove the new rubber goods from the tote and place their old rubber goods in the tote. Stores personnel will bring the tote back to the Storeroom.

Note: Rubber blankets will not be exchanged this time. Line hose will be exchanged instead. ETD staff should see their supervisor for details.

November 15, 2000

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Meter and Connection, Electric Production, Electric Meter Shop and Gas Distribution.

Electric Production will pick up their standard order from the Electric Meter Shop. Please exchange the new rubber goods for the old and return the old gloves to the Electric Meter Shop.

All other personnel with the exception of Meter and Connection personnel reporting to Fitchburg will exchange their rubber goods at the Electric Meter Shop. The rubber goods exchange for Meter and Connection personnel reporting to Fitchburg will be handled by the Superintendent - Electric Measurement and Service.

If you have any questions regarding the rubber goods exchange, please call John Capacio at extension 7038 or Jerry Peplinski at extension 7378.

cc:	Tom Branson	Edward Maass
	Tom Brice	Jim Miller
	Dave Crary	Phil Nelson
	Dan Feeney	Vern Wardell
	Craig Fenrick	Ken Wilke



DRIVER'S VEHICLE CONDITION REPORT

Truck/Tractor No.	Trailer No.	Date In Service	Time In Service	Mileage In Service	Driver Signature In Service
-------------------	-------------	-----------------	-----------------	--------------------	-----------------------------

Preventive Maintenance Inspection Due? ☐ Yes ☐ No . . . Neglecting a small defect today, may mean a major repair job tomorrow.

Driver's Checklist:

Check box if satisfactory

Engine <input type="checkbox"/> Check for Oil, Water and Fuel Leaks <input type="checkbox"/> Knocks <input type="checkbox"/> Misses <input type="checkbox"/> Hard Starting <input type="checkbox"/> Overheating <input type="checkbox"/> Other _____	Springs/Suspension <input type="checkbox"/> Broken <input type="checkbox"/> Other _____	Electrical <input type="checkbox"/> Check Trailer Light Cord <input type="checkbox"/> Lights: Head, Tail, Stop, Turn, Clearance <input type="checkbox"/> Reflectors <input type="checkbox"/> Other _____	Emergency Equipment <input type="checkbox"/> Fire Extinguishers <input type="checkbox"/> Spare Fuses <input type="checkbox"/> Tire Chains <input type="checkbox"/> Three Reflective Triangles
Clutch <input type="checkbox"/> Check for Slipping or Grabbing <input type="checkbox"/> Other _____	Brakes <input type="checkbox"/> Check Trl. Connections <input type="checkbox"/> Parking Brakes <input type="checkbox"/> Service Brakes <input type="checkbox"/> Check for Air or Hydraulic Leaks <input type="checkbox"/> Other _____	Tires <input type="checkbox"/> Repair Tire <input type="checkbox"/> Check Spare <input type="checkbox"/> Check Wheel and Lug Bolts <input type="checkbox"/> Other _____	Boom and Outriggers (if applicable) <input type="checkbox"/> Proper operation of controls <input type="checkbox"/> Wear and contamination of operating controls <input type="checkbox"/> Malfunction of safety devices <input type="checkbox"/> Excessive leakage or deterioration of hydraulic and pneumatic systems <input type="checkbox"/> Insulation checked for damage or contamination <input type="checkbox"/> Condition of electrical apparatus
Transmission <input type="checkbox"/> Noisy <input type="checkbox"/> Hard Shifting <input type="checkbox"/> Leaks <input type="checkbox"/> Other _____	Rear Axle <input type="checkbox"/> Noisy <input type="checkbox"/> Grease Leaks <input type="checkbox"/> Other _____	Miscellaneous <input type="checkbox"/> Drive Line <input type="checkbox"/> 5th Wheel, Safety Chains and Pintle Hook <input type="checkbox"/> Door Glass, Windshields and Mirrors <input type="checkbox"/> Other _____	
Steering <input type="checkbox"/> Looseness <input type="checkbox"/> Shimmy <input type="checkbox"/> Steers Hard <input type="checkbox"/> Other _____	Instrument Panel <input type="checkbox"/> Oil Pressure Gauge <input type="checkbox"/> Ammeter <input type="checkbox"/> Horn <input type="checkbox"/> Windshield Wipers <input type="checkbox"/> Speedometer <input type="checkbox"/> Other _____		

Repair Orders Must Be Clearly Stated Here:

Maintenance Action: ☐ Corrective Action Taken On All Items ☐ Corrective Action Taken Except Items Listed Below

Explain Below

Signature _____

Date _____

Signature _____

Date _____

Parts Used _____

Date Out Service	Time Out Service	Mileage Out Service	Driver Acknowledgment Out Service
------------------	------------------	---------------------	-----------------------------------

White - R.O.

Yellow - Driver

88-1774-3



Inspection Code ✓ OK 0 Follow-Up Needed x Adjustment Made

The above tire prints are to be used to record existing tread depths and air pressures.

Items not listed on this form but found to be in need of attention are to be written on a repair order.

GASOLINE OR LIMITED DUTY DIESEL POWERED VEHICLE INSPECTION

Inspection Code

☒ OK

☐ Follow-Up Needed

☐ Adjustment Made

Lubrication		
Lubricate Chassis And Accessories		
Lubricate Door Hinges And Latches		
Check These Lubricant Levels		
1. Manual Steering box		
(A & B Only) 2. Power Steering Fluid		
3. Brake Master Cylinder		
4. Clutch Master Cylinder		
(A Only) 5. Automatic Trans. Fluid		
6. Manual Trans. Lube		
7. Two Speed Motor		
8. Differential Lube		
9. Check Trans. And Differential Breathers		
Change Engine Oil		
Change Engine Oil Filter		
(C Only) Change Power Steering Fluid & Filter		
(B & C Only) Change Auto. Trans. Fluid & Filter		
Brake Lining & Wheel Bearings		
Front Wheels:		
1. Inspect Disc Brakes Each PM. Record The % Of Lining Left _____		
(B & C Only) 2. Inspect Drum Brakes, Record The % Of Lining Left _____		
3. Inspect, Repack Grease Lubed Brgs.		
(C Only) 4. Inspect, Relube Oil Lubed Brgs.		
Rear Wheels		
Check For Loose Or Noisy Bearings		
(B & C Only) Record % Of Lining Left _____		
(B & C Only) Adjust Brakes, Front & Rear		
Battery Inspection		
Check & Record Color Of State Of Charge Indicators Or Open Circuit Voltage		
#1 _____ #2 _____		
Check For Corrosion		
Check Terminals & Cables		
Check Hold-Downs & Box Mounting		
(Each C) Load Test, Record Readings		
#1 Amps _____ #2 Amps _____		
Volts _____ Volts _____		
Cranking System		
Make Visual Inspection		
Make Starter Cranking Test		
Replace Starter Each 96,000 Miles/4 Years		
Charging System		
Make Visual Inspection		
(B & C Only) Check/Record Output Volts _____		
Replace Alt. Each 96,000 Miles/4 Years		
Air Cleaner Service		
Remove, Clean & Inspect Element		
Clean Inside Of Air Cleaner Housing		
Check Housing And Mounting Gasket		

Gas Engine Tune-Up And Service (C Inspection Only)		
1. Remove, Disassemble, Clean, Inspect, Reassemble & Reinstall Dist.		
2. Replace Coolant Hoses (Except Silicone)		
(B & C Inspection Only)		
1. Wash Dist. Cap & Rotor		
2. Inspect Secondary Wiring		
3. Replace Spark Plugs		
4. Reassemble Ignition System		
5. Check Exhaust Control Valve		
6. Check EGR Valve		
7. Replace PCV Valve		
8. Replace PCV Filter		
9. Clean PCV Hoses, Test System		
10. Check Air Injection System		
11. Change Fuel Filter(s)		
12. Check Choke For Proper Operation		
13. Tighten Carb. Screws & Hold Down Bolts		
14. Check Carb. Redundant Linkage		
15. Set Initial Timing		
16. Check Timing Advance		
17. Adjust Idle Speed & Mixture		
Each Inspection		
Check Governor Lines and Seals		
Record Governed Speed _____		
Listen For Unusual Noises/Missing		
Diesel Engine Tune-Up and Service		
(B & C Only) Replace Fuel Filter		
GM 6.2L: Inspect Exh. Press Reg. Each 12,000 Miles		
Service Crankcase Vent Each 12,000 Miles		
Replace Bearings Each 96,000 Miles		
Navistar 6.9L: Replace Bearings Each 96,000 Miles		
(C Only) Check And Record Toe-In _____		
Check License Plate & Brackets, Permits And State Safety Inspection Sticker		
Check Lift Gate Condition & Operation		
Check Overhead & Swing Doors		
Check Loading Ramp		
(One Ways) Record Inspection		
(Except O/W) Attach PM Reminder Sticker		
(C Only) Repaint Wheels As Required		
Refrigeration Unit		
1. Check PM Status		
2. Check For Physical Damage, Loose Mounts, Etc.		
3. Check/Service Engine Oil Level		
4. Check/Service Engine Coolant Level		
5. Check For Loose Belts, Components, Etc.		
6. Check Battery, Clean & Service As Required		
7. Run Unit, Check For Proper Operation		
Road Test, Check For Proper Operation		